European Commission

JRC TECHNICAL REPORTS

The Impact of the 2013 CAP Reform on the Decoupled Payments' Capitalization into Land Values

Pavel Ciaian, d'Artis Kancs,
Maria Espinosa

2016

EUR 27940 EN

Contact information
Pavel Ciaian
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: pavel.ciaian@ec.europa.eu
Tel.: +34 95 448 8429
Fax: +34 95 448 8300

JRC Science Hub
https://ec.europa.eu/jrc

JRC101619

EUR 27940 EN

PDF ISBN 978-92-79-58541-8 ISSN 1831-9424 doi:10.2791/698744

Luxembourg: Publications Office of the European Union, 2016

How to cite: Ciaian, P., D. Kancs and M. Espinosa (2016). The Impact of the 2013 CAP Reform on the Decoupled Payments' Capitalization into Land Values. EUR 27940 EN, Joint Research Centre, European Commission, doi:10.2791/698744

Table of contents

List of figures

List of tables

List of abbreviations

ANC	Areas of Natural Constraints
BPS	Basic Payment Scheme
CAP	Common Agricultural Policy
CATS	Clearance of Accounts Audit Trail System
DCNDP	Decoupled Complementary National Direct Payments
DG-AGRI	Directorate-General for Agriculture and Rural Development
EFA	Ecological Focus Area
EU	European Union
FADN	Farm Accountancy Data Network
FSS	Farm Structure Survey
GAEC	Good Agricultural and Environmental Condition
MS	Member States
NMS	New Member States
OECD	The Organisation for Economic Co-operation and Development
OMS	Old Member States
RDP	Rural Development Programme
SAPS	Single Area Payment System
SMR	Statutory Management Requirements
SPS	Single Payment Scheme
UAA	Utilized Agriculture Area
UK	United Kingdom

The Impact of the 2013 CAP Reform on the Decoupled Payments' Capitalization into Land Values[1]

Pavel Ciaian, d'Artis Kancs, Maria Espinosa

DG Joint Research Centre, European Commission

Abstract

Decoupled direct payments were introduced in the European Union (EU) by the 2003 CAP reform in form of the Single Payment Scheme (SPS) and the Single Area Payment System (SAPS). The 2013 CAP reform changed both the implementation of decoupled payments as well as its budget. We assess the possible effects of the 2013 CAP reform on the capitalization of decoupled payments in land rental values. Our estimates suggest that the CAP reform leads to an increase in the capitalization of decoupled payments by additional 16 cents for each EUR of decoupled payments relative to the pre-reform situation. However, there is a relatively large variation in the reform effects between MS particularly between Old Member States (OMS) and New MS (NMS). In NMS the capitalization rate slightly reduces from 76% in the pre-reform period to 72% in the post-reform period. Although, the rate is significantly lower in OMS, it almost doubles (from 20% to 39%) due to the reform. The main source of the post-reform capitalization in the EU are the entitlement stock changes accounting for 19% of total post-reform capitalization level, followed by the internal convergence of payments with 18%, the budget change (including external convergence) with 1%, and the differentiation of payments (redistributive payment) with -7%. Overall, our estimates suggest that on average in the EU, the non-farming landowners' policy gains are 25% of total decoupled payments in the post-reform period compared to 17% in the pre-reform period.

Key words: Capitalization, Decoupled subsidies, CAP reform, Land market, Land prices, Land rents, EU.

JEL codes: H22, Q11, Q18.

1. Introduction

Annually, the European Union (EU) spends around 58 billion euro on the Common Agricultural Policy (CAP) with the aim of supporting farmers' income and the production of public goods, such as landscape and clean environment. The majority of CAP subsidies are disbursed in form of decoupled direct payments represented by the Single Payment Scheme (SPS) and the Single Area Payment System (SAPS). Decoupled payments were introduced by the 2003 CAP reform. In 2013 they underwent substantial reform changing both the implementation form and the payment level (EU 2013; European Commission 2013b;

[1]The authors are solely responsible for the content of the paper. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

European Commission 2016).

The capitalization of agricultural subsidies was subject to extensive empirical and theoretical research in the literature. Both empirical and theoretical findings suggest that agricultural subsidies increase land prices and thus generate benefits also to landowners. However, there is no consensus on the magnitude of the actual capitalization effects of subsidies, as it depends on a number of factors such as type of support, imperfections in factor markets, the structure of competition in the food supply chain and transaction costs (Alston and James 2002; de Gorter and Meilke 1989; Dewbre, Anton, and Thompson 2001; Gardner 1983; Guyomard, Mouël, and Gohin 2004; Desquilbet and Guyomard 2002; Kirwan 2009; Sheldon, Pick, and McCorriston 2001; McCorriston and Sheldon 1991; Salhofer and Schmid 2004; Ciaian and Swinnen 2006; 2009; de Gorter 1992). Further, there is a significant discrepancy between the empirical and theoretical findings as estimations tend to suggest a lower capitalization of agricultural subsidies than the theory implies. This is particularly the case of area-based subsidies such as the SPS and the SAPS. While the theory is able to rank clearly the various types of area-based agricultural subsidies by their incidence level, the empirical evidence is less conclusive on the exact capitalization rate (Patton et al 2008; Breustedt and Habermann 2011; Ciaian and Kancs 2012; Kilian et al. 2012; Van Herck Swinnen and Vranken 2013; Guastella et al. 2014; O'Neill and Hanrahan 2016).

There are a growing number of studies analyzing the capitalization of EU decoupled subsidies. Most studies have analyzed capitalization effects of the 2003 CAP reform (e.g. Ciaian, Kancs, and Swinnen 2008; Courleux et al. 2008, Kilian and Salhofer 2008; Ciaian and Kancs 2012; Kilian *et al.* 2012; O'Neill and Hanrahan 2016; Van Herck, Swinnen and Vranken 2013; Michalek, Ciaian and Kancs 2014; Guastella et al. 2014; Feichtinger and Salhofer 2015a, 2015b; Klaiber, Salhofer and Thompson 2016). The capitalization of the 2013 CAP reform was studied to a much lesser extent. To our knowledge only Gocht et al. (2013) and Ciaian, Kancs and Swinnen (2014) analyzed potential capitalization effects of the 2013 CAP reform proposal prior to its adoption and implementation.

The 2013 CAP reform provides a menu of possible options to implement decoupled subsidies. Member States (MS) could choose the exact reform strategy of their decoupled subsidies from a pre-defined set of options leading to a large heterogeneity in implementation between countries. The main CAP reform elements that vary between MS include: harmonization of payments between farms (internal convergence), differentiation in per hectare payments (redistributive payment) and changes in the reference period for the entitlement allocation. Additionally, the reform led to budgetary changes and partial harmonization of decoupled payments across MS (external convergence) as well as it introduced the 'CAP greening' top-up component of decoupled payments aiming at linking them to "agricultural practices beneficial to climate and environment" (EU 2013; European Commission 2016).

The objective of this study is to analyze the expected capitalization effects of the 2013 CAP reform; that is to what extent decoupled payments are incorporated into higher land values. We investigate the specific implementation of the 2013 CAP reform across MS and analyze how different elements of the 2013 reform may alter the capitalization rate relative to the pre-reform period. The main contribution of this study to the existing literature is to provide a detailed overview of expected capitalization effects of the 2013 CAP reform by accounting for the implementation heterogeneity across MS. This paper is a follow-up analysis of the study "*Possible Effects on EU Land Markets of New CAP Direct Payments*" prepared for the European Parliament in 2013, which analyzed the reform proposal and did not consider its actual implementation.[2]

The SPS capitalization has important policy implications for the EU. Decoupled payments may be leaked to landowners instead of farmers, if the CAP reform increases the decoupled payment capitalization into higher land values. The level of decoupled payment leakage to non-farming sector depends on the extent of land renting (which is quite significant in EU). On average 54%, of farmland is rented in the EU. However, there are important differences among EU Member States because of differences in land market structure (Ciaian, Kancs and Swinnen 2010). MS with a high share of rented land (more than 70%) include Slovakia, Bulgaria, the Czech Republic, France, Belgium and Malta. MS with a low share of rented land (less than 30%) include Denmark, Ireland, Poland and Portugal. These variations affect the extent to which farmers versus non-farming landowners capture policy rents. While there is some farm-to-farm land renting in the EU, by far most of the rented out land is owned by non-farming landowners.

The study is organized as follows. The following section describes agricultural land markets in the EU. The third section introduces decoupled payments in the pre- and the post-2013 CAP reform period. The fourth section summarizes the main findings from the literature on the pre-reform capitalization of decoupled payments. The fifth section describes the conceptual and the empirical framework to analyze the impact of each element of the 2013 CAP reform on the decoupled payment capitalization, followed by the results described in the section six. The seventh section draws conclusions.

2. Agricultural land markets in the European Union

The farmland sales markets are relatively thin in the European Union. The share of the annually transacted agricultural land area in the total utilized agriculture area (UAA) ranges between 0.1% in Slovakia to 8% in Lithuania (Table 1). The transacted area tends to be stable over time in Old Member States (OMS).[3] In New Member States (NMS),[4] the available

[2] http://www.europarl.europa.eu/RegData/etudes/etudes/join/2013/495866/IPOL-AGRI_ET%282013%29495866_EN.pdf

[3] OMS refers to Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and Sweden, and the United Kingdom.

evidence suggests an increase in the transacted area over time, eventually induced by structural changes in agriculture due to the transition process and the EU enlargement (Ciaian et al. 2012).

Land sales price developments show greater dynamics. Overall, an upward trend in price development tends to prevail in land sales across EU Member States in the period 1995–2009 (Figure 1). The observed price increase can be explained by the food price increase, a shift to a land-based subsidy system in the EU, and a general productivity growth (Ciaian and Kancs 2012; Michalek et al. 2014).

The levels of agricultural land sales prices vary strongly within the EU. Figure 1 compares the level of sales prices among EU Member States in 1995, 2002, and 2009. The strongest difference in the price level is between OMS and NMS. On average, land prices in OMS are several times higher than in NMS and these price differences tend to persist over time. The lowest land price is recorded in Lithuania followed by Latvia, Bulgaria, and Slovakia. In contrast, the Netherlands recorded the highest agricultural land prices in the EU. Land prices are also high in Denmark and Luxemburg. From the surveyed NMS, the Czech Republic has the highest land prices. Nevertheless, if compared to the Netherlands, the Czech prices were lower by factor 20 in 2009. Sweden and France have more comparable price levels to NMS, though the gap is still substantial, more than 50% higher, when compared to land prices in the Czech Republic.

The land rental market seems to be more important than the sales market in terms of the agricultural area. The share of the rented land in the EU represented 54% of agricultural area in 2013, increasing from 52% in 2004 and from 50% in 2000. There is a strong variation in land renting among the Member States. In OMS, the share of rented land in 2013 ranged between 19% in Ireland and 88% in France, while in NMS it ranged between 27% in Poland and 94% in Slovakia (Table 2).

During the period 2004–2013, the land renting decreased in roughly one half of Member States, but increased in the other half. However, increases in the land renting tend to be larger (varying between 3% and 20%) than decreases (varying between -1% and -10%). A particularly strong expansion of the land renting (more than 10%) occurred in Greece, Italy, Latvia, Slovenia, Spain and Sweden. Countries with the most significant decrease in the land renting (more than -5%) include Austria, Germany, Hungary, Portugal and the Czech Republic (Table 2).

The rental price heterogeneity between Member States is less accentuated than the land sales price heterogeneity. Nevertheless, the cross-country variation has grown over time (from 1000% between the lowest and highest countries in 2000 to over 3500% in 2013). Although, rental prices are in general higher in OMS, several OMS (e.g., Portugal, Spain) report comparable levels to NMS. Rental prices varied in 2013 from €25 per hectare in Latvia

[4] NMS refers to Member States which joined the EU in 2004 or later: Bulgaria, Croatia, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

to €974 per hectare in the Netherlands. However, in most Member States the agricultural land rental prices were in the range between €100 and €300 per hectare in 2013 (Table 3). With the exception of Greece, Ireland, Italy and the UK, rental prices increased in during period 2004–2013. The rental price increase is significantly higher in NMS than in OMS, which was likely induced by productivity growth and the introduction of the CAP subsidies after the EU enlargement (Ciaian and Kancs 2012; Swinnen et al. 2013).

3. Decoupled payments in the EU

3.1. Pre-reform decoupled payments

Two types of decoupled payments were implemented in the European Union prior to the 2013 CAP reform: the Single Payment Scheme (SPS) and the Single Area Payment Scheme (SAPS). Both types of decoupled payments were introduced by the 2003 CAP reform.

Under the SPS, each farm was allocated a certain amount of the SPS entitlements. Farms are eligible for the SPS if they have both entitlements and an equal amount of an eligible land. The SPS is linked to land because, in the absence of an eligible land, farms cannot activate (cash in) the SPS entitlements. However, the SPS is not linked to a specific land area – the SPS entitlements can be activated by any eligible farmland in the region. Farms can expand or decrease their stock of entitlements by buying or selling entitlements on the agricultural land market.[5]

When implementing the SPS, MS could choose between three different SPS models: the *historical* model, the *regional* (*flat-rate*) model, and the *hybrid* model. Under the historical model, the SPS is farm-specific and equals the support the farm has received in the "reference" period, i.e. when coupled subsidies were disbursed. Under the regional model, an equal per hectare payment is granted to all farms in a given region. The hybrid model is a combination of historical and regional models. The key difference between the three models is in the unit value of entitlements: under the historical and hybrid models, the value of entitlement varies between farms (stronger in the former than in the latter), whereas under the regional SPS model, all farms within a region have entitlements with the same unit value.

The most commonly implemented SPS model in the EU is the historical model. It is used in Austria, Belgium, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, and Wales and Scotland (UK). Malta and Slovenia implement the regional SPS model. Denmark, Finland, Germany, Luxemburg, Sweden, England and Northern Ireland (UK) use the hybrid model (either the static or dynamic version). MS implementing the dynamic hybrid model gradually move to a fully regional (flat-rate) model (Finland, Germany, UK- England), whereas MS implementing the static hybrid model maintain the payment variation across farms (i.e. the regional and historical shares do not change over time) (Denmark,

[5] Note that entitlement trade is allowed only within MS, not between them, implying that a given entitlement can be activated only on the land in a given MS.

Luxembourg, Sweden, UK- Northern Ireland).

Table 4 reports the number of activated entitlements relative to the utilized agricultural area (UAA) for MS which implement the SPS. In several MS, the share of activated entitlements roughly correspond to the UAA (e.g. Denmark, Germany, Finland, Sweden), whereas in other MS the ratio of activated entitlements to UAA is significantly below one (e.g. Spain, Italy, Malta, France, Portugal). The share of activated entitlements in the UAA tends to be larger in countries that have implemented the hybrid model than in countries using the historical model. This is because under the historical model the total number of entitlements corresponds to the number of hectares that was eligible to subsidies in the reference period. Under the hybrid model (or regional model), the total number of entitlements was equal to the entire eligible land area at the time of the SPS introduction.

The SAPS is implemented only in NMS. A key difference between the SAPS and the SPS is the area eligible for the decoupled payment. Under the SAPS, the entire eligible area that farmers use can receive a per hectare payment; there are no entitlements as in the case of the SPS. Another key difference between the SAPS and the SPS is in the value of the per hectare payment. Under the SAPS, all farms in a every Member State (or region within a Member State) receive an equal per hectare payment (i.e. flat-rate payment), whereas under the SPS, the payment value can differ depending on the type of the SPS model.

Farm eligibility for decoupled payments is subject to cross-compliance. Each farm that receives the SPS/SAPS must comply with the Statutory Management Requirements (SMR), and maintain land according to the Good Agricultural and Environmental Condition (GAEC). The SMR are based on EU regulations in fields of environment, public, animal and plant health, and animal welfare. The GAEC includes a set of standards requiring farms to ensure the soil protection, the maintenance of soil organic matter and soil structure, and the safe-guarding of landscape features and habitats.

3.2. The 2013 CAP reform

The key changes introduced by the 2013 CAP to decoupled payments can be summarized as follows (EU 2013; European Commission 2015, 2016):[6]

I. *Budget change and external convergence of payments*: The budget allocated to

[6] The 2013 CAP reform replaced the SPS payments with the basic payment scheme (BPS). Similarly as the SPS, the BPS is also based on payment entitlements that can be activated only if accompanied by eligible land. The key difference between the SPS and the BPS is that the latter grants basic layer of support to farmers which is topped-up by other payments targeting specific issues or specific types of beneficiaries such as the greening payments, redistributive payments, etc. (European Commission 2016). Thus the total value of decoupled payments a farm receives is equal to BPS plus other top-up payment elements (i.e. greening payments, redistributive payments, payments for Areas of Natural Constraints (ANC), the young farmer scheme, the Decoupled Complementary National Direct Payments (DCNDP) for new MS. In addition, in case farms exceed a certain threshold (the default value is 150000 Euros), the total BPS payments get reduced (capping). To simplify the terminology and keep it consistent over the whole paper we refer to these payments as SPS (i.e. the combined value of BPS, greening payments and redistributive payment. The ANC, capping, young farmer scheme and DCNDP are not considered in the total SPS value.

decoupled payments (SPS and SAPS) for MS changes for several reasons: the overall budget was reduced, there was a partial harmonization of payments across MS, the CAP budget could be reallocated between coupled subsidies or other CAP expenditures (e.g. the Rural Development Programme (RDP).

II. *Internal convergence of payments:* The CAP reforms require a convergence of the SPS payments, which implies a harmonization of the SPS across farms (i.e. towards a flat-rate SPS value) at MS (or regional) level.

III. *Differentiation of payments*: Some changes increase the differentiation in per hectare payments to certain farm types. The most important reform element that differentiates payments between farms is the redistributive payment under which farmers may receive a higher payment value for the first hectares than for the rest of area. This reform element increases the differentiation of the per hectare payment value within MS and regions (and thus goes in an opposite direction as compared to the internal convergence of payments). Another elements that affects the differentiation of total decoupled payments are the ANC, young farmer scheme, capping and DCNDP. However, the impact of these payments is not analyzed in this paper as their size is relatively small.

IV. *Entitlement allocation method*: MS can choose to maintain old entitlements or to allocate new entitlements.

V. *CAP greening:* There are stronger linkages of decoupled payments to "agricultural practices beneficial to the climate and environment" (the so called *'CAP greening'*).[7]

The 2013 CAP reform offers certain flexibility to Member States regarding specific implementation of these five reform elements. Thus, the actual adoption of the different reform elements could differ between MS. However, the choice is not fully flexible and depends on the past implementation system of decoupled payments. For example, MS that had heterogeneous value of payments across farms (e.g. the historical SPS model) are required to (fully or partially) harmonize them. The MS applying the SAPS may extend the use of this system; however this scheme is not available to MS that implemented the SPS under the previous CAP.

[7] SPS will be supplemented by an additional 'greening' payment taking up to 30% of the total direct payment funds, if farms respect the 'greening' requirements: crop diversification, maintenance of permanent grassland and ecological focus area (EFA). Under the crop diversification, the cultivation of the arable land needs to include at least two different crops on farms cultivating between 10 and 30 hectare of arable land and at least three crops on farms with a larger arable area. The main crop should not exceed 75% of arable land, and the two main crops should not exceed 95% of the arable area. Under the maintenance of permanent grassland, farms are required not to convert and to plough permanent grassland. The EFA measure requires farms larger than 15 hectares to allocate at least 5 % of farms' eligible area (excluding areas under grassland) to ecological focus area, with the possibility of increasing this percentage to 7% subject to an evaluation review in 2017. The area that qualifies as ecological focus area includes fallow land, terraces, landscape features, buffer strips, green cover, etc. In order to avoid penalizing those farms that already address environmental and sustainability issues, the "greening equivalency" system is applied whereby the application of environmentally beneficial practices already in place are considered to replace these three basic greening requirements (EU 2013).

Further, Member States may apply the decoupled payment scheme at the regional level by splitting country in separate regions among which the reform implementation could differ. Among the 18 MS implementing the SPS prior to the reform, six decided to regionalize the SPS: France (two regions: Corcega and Hexagon), Germany (by administrative regions), Finland (two regions determined by natural constraints), Spain (50 regions determined by historical land uses (irrigate, non- irrigated, permanent crop and grassland) and county), Greece (regions determined by historical land uses: grazing areas, arable land and permanent crops), United Kingdom (three regions in England determined by natural characteristics[8] and three regions in Scotland determined by land uses and natural characteristics). The remaining 12 MS apply the SPS at the national level. Member States that applied the SAPS before the reform continue to apply the SAPS at the national level (European Commission 2015, 2016). The main consequence of the regional implementation of decoupled payments is that the payment value per hectare may differ between regions within MS even if each region implements a flat-rate system (e.g. the regional SPS model).

4. Pre-reform capitalization: Insights from the literature

4.1. Previous conceptual studies on the SPS

Previous studies that have conceptually investigated the impact of decoupled payments on land markets (Ciaian and Swinnen 2006; Courleux et al. 2008; Ciaian, Kancs, and Swinnen 2008, 2010; Kilian and Salhofer 2008; Feichtinger and Salhofer 2013; Viaggi et al. 2013) show that their implementation details are important determinants of the magnitude of the capitalization level. The key findings of the previous literature can be summarized as follows:

The capitalization *of the SPS depends strongly on the ratio of the eligible area to the total number of entitlements.* If there are more entitlements ("surplus") than the eligible area, then the SPS leads to a land price increase ("is capitalized in land prices"). However, if there are less entitlements ("deficit") than the eligible land, then the SPS does not increase land prices ("not capitalized in land values"). The intuition is that the more entitlements are allocated to farms (compared to the eligible land), the more farms will compete for the eligible land to activate entitlements in order to cash the SPS. The increased demand for land will cause land prices to go up.

The share of the SPS that is capitalized is higher for low than for high payments. As farms with high value entitlements compete with farms holding low value entitlements, farms owning high value entitlements can afford to pay higher rents, but will only bid up the land rent to the low value entitlements, at maximum. Thus, low value entitlements will determine the SPS capitalization at the margin.

The capitalization of the SPS in land prices is higher under the regional (flat-rate)

[8] English non-SDA (Severely Disadvantage Area); English-SDA non-moorland; English SDA-moorland.

SPS model than under the historical SPS model. With the regional model there is no difference in the SPS entitlements among farms, while there may be large differences with the historical model. An implication of this is that the larger are the differences between farms in terms of the SPS entitlements, the smaller will be the capitalization of the SPS – because the smallest value will determine the level of capitalization. Hence, everything else equal, the SPS capitalization will be higher in the regional model.

The more difficult it is to trade entitlements, the more the SPS becomes capitalized into land values. Under constrained trade, farms are more likely to keep their entitlements (instead of selling them) and to use them to compete for land, which exerts an upward pressure on land prices. In other words, entitlements indirectly become farm specific or practically attached to the farmer's land if trade is constrained. In contrast, facilitation of entitlement trade may actually play a role in reducing the potential SPS capitalization, as it will reduce pressure of the SPS on land markets. In principle, full tradability cuts the link between entitlements and a specific land area or a specific farmer thus reducing the SPS impact on the land market. The impact of the tradability on the SPS capitalization is more significant in the case of deficit entitlements. With surplus entitlements, the SPS is capitalized anyway, implying that tradability is less important in determining the capitalization. In this case low tradability also leads to a higher SPS capitalization but its effect is rather secondary and thus smaller in the magnitude.

The capitalization rate will be equal or higher under the SAPS than under the SPS. There are no entitlements associated with the SAPS, and all farms receive the same value of per hectare payment. Given that there are no entitlements associated with area payments - all farms receive the same value of the subsidy and all eligible land can benefit from them - their impact on land rents is similar to the case of the regional SPS model with flat-rate payments and with surplus entitlements. This implies that, for an equivalent value of area payment, the capitalization rate of the SAPS is equal to or higher than the capitalization rate of the SPS.

The capitalization of decoupled payments in land prices is higher when the supply of land is less elastic. In the extreme case, with fixed land supply, decoupled payments may get fully capitalized in land prices, i.e. all subsidies go to landowners because the land rent increase is equal to the subsidy per hectare. This result holds both for the SAPS and for the SPS, if there are sufficient entitlements.

The capitalization of decoupled payments in land prices might be lower with cross-compliance. Cross-compliance requirements imply additional costs to land users, which reduces the demand for land and thus the (positive) effects of decoupled payments on land rents will be smaller.

The capitalization of decoupled payments in land prices is lower when land prices are regulated. Land market regulations in the EU-27 vary strongly among Member States.[9] Of

[9] See Swinnen, Van Herck, and Vranken (2013) for a detailed analysis of land market regulations in EU Member States.

particular importance for decoupled payments capitalization are *maximum price regulations*. The potential capitalization of decoupled payments into land rents will be reduced in the presence of a rental price ceiling. On the other hand, to overcome the rental price regulation (i.e. the maximum price intervention), farmers will have the incentive to pay unofficial payments (bribe) to landowners to prevent the loss of land to competing farms.

The capitalization of decoupled payments in land prices is higher when they reduce credit constraints. Many farms, in particular in the poorer rural regions of the EU, face credit market constraints. Access to cash payments (decoupled payments) may reduce credit market constraints, either directly by increasing farms' cash flow or indirectly through an easier access to bank loans. This will increase capitalization of decoupled payments, because it increases farm productivity and hence the demand for land.

(Changes in) the capitalization of decoupled payments in rental prices is more gradual with long term rental contracts. With short run contracts (as e.g. in Ireland), the rental price adjustments can occur fast to changes taking place in the land market (including changes to decoupled payments); with long term contracts the rental price adjustments will occur more slowly, as rental price may change only upon a contract expiration. The length of the rental contracts vary strongly (often because of regulations) across EU regions with many MS having the rental contract duration longer than 5 years or more (e.g. Belgium and France, the Netherlands, Slovakia).[10]

4.2. Empirical evidence

There are a growing number of studies empirically estimating the capitalization of pre-reform decoupled subsidies. The results of these studies are summarized in Table 5. All studies can be regrouped into two broad categories: land sales price studies and land rental price studies.[11] Most studies focus on land rental prices since data on land rents are more widely available. Land sales price studies usually estimate the capitalization elasticity representing the percentage change in land price per 1 percent increase in subsidies, whereas rental studies typically estimate capitalization rate measuring the share of subsidy capitalized into land rents.

Two studies, using very different datasets, have estimated the impact of the SAPS on land rents in NMS. Ciaian and Kancs (2012) use a firm-level panel dataset of more than 10,000 farms in seven NMS in 2004 and 2005. Van Herck, Swinnen and Vranken (2013) use country level-data on average land rents and the SAPS for six NMS over the period 1994–

[10] According to Ciaian, Kancs, and Swinnen (2010), the key determinants of rental contract durations in the EU are social norms (e.g. in Greece), governmental regulations (e.g. there is a minimum of 9 years in Belgium and France, 6 years in the Netherlands and 5 in Spain), and market institutions (e.g. Germany, Italy, Sweden). Moreover, in several countries (e.g. France) even the renewal of rental contracts is regulated.

[11] The capitalization effect on land sale price is equivalent to the capitalization effect on rental prices if the sale prices follow the asset pricing formula where land price equals the sum of discounted future rental prices.

2009. Both studies find remarkably similar results: they find that between €0.15 and €0.32 per additional euro of the SAPS is capitalized in higher rental prices. These estimates appear somewhat low, given that theory suggests a considerably higher capitalization rate. One explanation for this rather low capitalization level could be the presence of land market rigidities (including regulations) that hamper the full adjustment of land sales and rental prices, particularly given that both studies cover the first few years of the SAPS implementation when its full effect might have not materialized.

The estimates of the capitalization rates for the SPS vary more across studies. This is mainly because of a different regional coverage, which captures different SPS implementation models as well as due to the variation of estimation methodology between studies (Table 5). Michalek et al. (2014) estimate the capitalization of the SPS into land rents using farm-level data across OMS for the early period of the SPS implementation (2004 to 2007). They find a relatively low capitalization rate of only 6% to 10%. However, Michalek, Ciaian and Kancs (2014) also show that there is a significant variation in the SPS capitalization rate across OMS, among regions and among farms. Moreover, their estimates confirm the theoretical predictions of lower SPS capitalization in the historical model than the hybrid model. O'Neill and Hanrahan (2016) estimate the short-run capitalization rate in the same magnitude for Ireland (historical model) as Michalek, Ciaian and Kancs (2014): between 7% and 25%. The long-run the capitalization rate is larger between 21% and 53%. Guastella et al. (2014) find a statistically insignificant impact of the SPS on land rents in Italy, where the historical SPS model is implemented.

Nilsson and Johansson (2013) analyze the SPS impacts in Sweden, whereas Kilian et al. (2012), Feichtinger and Salhofer (2015b) and Klaiber, Salhofer and Thompson (2016) analyze the SPS impacts in Bavaria (Germany) and find a comparably high capitalization rate. The former study finds that the elasticity of agricultural land sales price with respect to the SPS is 0.54 (i.e., a 1 percent increase in the SPS increases land sales price by 0.54 percent), whereas the latter three studies find that 35% to 94% of the SPS are capitalized into land rental prices. Both Sweden and Germany implement the hybrid model where the entitlements are more abundant relative to total land and payments are more homogenous, which, according to the theoretical predictions, is expected to result in a higher capitalization of the SPS. Similar to Michalek, Ciaian and Kancs (2014), the estimates of Klaiber, Salhofer and Thompson (2016) show that the gradual transition to harmonized payments (the regional SPS model) in Germany led to an increase of the capitalization rate from 37% in 2005 at the time of the SPS introduction when decoupled payments were most heterogeneous to 57% in 2012 when the payments were partially harmonized.

In contrast, Karlsson and Nilsson's (2014) estimates suggest no impact of the SPS on land sales prices in Sweden (hybrid model). This contradicts the findings of Nilsson and Johansson (2013). Both studies use the same data from the Swedish Mapping, Cadastral and Land Registration Authority for the period January 2007 to December 2008. The two studies

differ in the methodology they employ. Karlsson and Nilsson (2014) use a spatial multilevel model that accounts for spatial spillover effects and interdependencies, while Nilsson and Johansson (2013) apply asset-pricing model where land price is determined by the expected returns from its current and potential future uses. These differences in methodology imply that when controlling for interdependencies between local and regional factors and spatial spillover effects between neighboring farms, the SPS becomes unimportant in determining land sales prices. Similarly, Feichtinger and Salhofer (2015b) control for spatial spillover effects and interdependencies and find lower capitalization elasticity for sales prices in Bavaria in Germany (0.20–0.28) than Nilsson and Johansson (2013).

In general, with few exceptions, the estimated capitalization of the SPS appears to be more in line with theoretical predictions than the SAPS. However, the estimated capitalization rates for both types of payments could be underestimated due to the presence of various tenancy arrangements and land market regulations. In particular, long duration rental contracts and maximum rental price interventions applied in several countries can prevent full price adjustments or cause sluggish adjustment of land rents to subsidies, implying that the effect may not be full and immediate. Studies that focus specifically on short-term or new contracts find considerably higher capitalization rates. For example, Patton et al. (2008) in their analysis of Northern Ireland only include farms with rental contracts of one year or less, and exclude all longer-term rental contracts. They find that the capitalization of land-based subsidies (i.e. the Less Favoured Area payment) is more than 100%. Also Kilian et al. (2012) find that the SPS capitalization effect is significantly higher for newly signed rental contracts in Bavaria (Germany). Further, Latruffe et al. (2013) find that land market regulations linked to intervention of public authority (i.e., SAFER)[12] in land markets reduce land sales prices in Brittany (France). This is because of the pre-emptive rights of SAFER which allows maintaining lower market prices by purchasing land if price is too high and sell it back at a lower price.

5. Impact of the 2013 CAP reform

5.1. Conceptual framework

To provide theoretical insides of the impact of the 2013 CAP reform on the decoupled payment capitalization we adopt the stylized conceptual framework developed by Ciaian, Kancs and Swinnen (2014). The main reason for choosing this approach is that data on the effects of the new CAP instruments are not available and thus econometric estimations are not possible. In the next section, using the results of the conceptual analysis, we derive

[12] SAFER is regional organization in France in charge to control the local land markets through its power to buy, sell, and rent out agricultural land.

comparative static results and attempt to quantify the capitalization effects of the 2013 CAP reform.

Following Ciaian, Kancs and Swinnen (2014), we assume that: (i) output and variable input equilibrium prices are exogenous; (ii) there is a possibility for an increase or decrease in the total land use, i.e. upward sloping land supply; (iii) the entire land is owned by "landowners", who rent land to "farms"; (iv) there are two types of regions, which are equal in all respects except for the land supply; (v) there are two types of entitlements in the case of the SPS; (vi) the SPS entitlements are fully tradable within regions, but non-tradable between regions;[13] and (vii) decoupled payments are allocated to farms.[14]

The land market is illustrated in Figure 2. The horizontal axis shows the quantity of land, *A*, the vertical axis measures the rental price, *r*, and the decoupled payment, *t*. The aggregate land demand without decoupled payment is given by the downward sloping curve *DD*. The land supply in region 1 is given by curve S_1, and the land supply in region 2 is given by curve S_2. The land market equilibriums at the zero support regime, are (A_1^*, r_1^*) and (A_2^*, r_2^*) in region 1 and region 2, respectively. Although, the productivity is the same for all farms (i.e. the land demand is the same in region 1 and region 2), there is less land used in equilibrium in region 1 than in region 2 due to a lower land supply.

We consider two types of the SPS entitlements. The stock of type 1 entitlements, A_E^1, has a unit face value t^1, and the stock of type 2 entitlements, A_E^2, has a face value t^2. The aggregate stock of entitlements, $A_E{}^T$, is the sum of the two types, i.e. $A_E^1 + A_E^2 = A_E^T$. In the regional (flat-rate) model both types of entitlements have equal face value, $t^r = t^1 = t^2$. In the hybrid and historical models the face value of entitlements differs, $t^1 \neq t^2$. In the case of the SAPS there are no entitlements - all land, *A*, is eligible for receiving payment - and the payments per hectare are homogenous.

5.2. Budget change and external convergence of payments (Reform I)

The 2013 CAP reform implies a decline in the EU budget for decoupled payments due to the reduced overall CAP budget, and within the reduced overall budget, a reallocation of the SPS budget among MS due to the external convergence.[15] Further, the decoupled payment budget

[13] This latter assumption implies that entitlement ownership dos not matter with respect to which farms own them within the region; they will always end up with farms with highest willingness to pay for them in that region (for more details on entitlement tradability see Ciaian, Kancs, and Swinnen 2008).

[14] Such a conceptual framework is useful to analyze and understand the capitalization effects, but one should carefully interpret the results in the context of income distributional effects. Many farms in the EU own (at least part) of the land they operate. Hence, they are both "landowner" and "farm", but this differs strongly between farms and member states (and regions within member states). In addition, while we do not explicitly model land sales, the results of our analysis are relevant for land sales markets under plausible conditions. The results of this model can be extended to land sales markets if the sale price of land is assumed to be adequately approximated by the sum of discounted future rental prices. Kilian and Salhofer (2008) show that under these conditions, the rental price changes derived in the paper are equivalent to sale price changes.

[15] The aim of the external convergence is to rebalance the CAP support among MS. However, the external convergence does not fully harmonise the payments among MS; they are only partially adjusted either upwards

could change because MS could shift resources between coupled and decoupled payments as well as relocate between direct payments and the RDP support. This means that in MS with a high payment value per hectare the total decoupled subsidy budget may decline due to external convergence, whereas in the MS with a low payment value per hectare the total decoupled payment budget may increase. However, the other three factors may drive the budget change in either direction depending on the size of the effects.

Overall, the budget change will have a differentiated impact across MS, depending on whether the country will receive more or less from the SPS and whether entitlements are in deficit or in surplus.

As a starting point, we consider the flat-rate SPS model (i.e. regional model) with entitlements t^r in the pre-reform period. This is illustrated in Figure 2. If the total amount of entitlement is A_E^T (and entitlements can be traded) then the bold line D_rD represents the (kinked) demand curve with the SPS with the distance between both functions is determined by the level of the SPS (= t^r in the figure). Given that farms need land to activate their entitlements and cash-in the SPS, farms' willingness to pay for land increases by the value of entitlement, t^r. This holds until all entitlements are exhausted, i.e. up to A_E^T. After this point, land demand is the same with and without the SPS, as there are no unused entitlements available. The equilibriums with t^r in the pre-reform period are (A_{1r}, r_{1r}) and (A_2, r_2^*) in region 1 and region 2, respectively.

As is evident from Figure 2, the effects of CAP reform on the land market are very different in the two regions. In region 1, where there is a shortage of land compared to the amount of entitlements ($A_1^* < A_E^T$), the equilibrium changes. Consider the SPS budget increase which extends the entitlement value from t^r to t^{rh}, where $t^{rh} > t^r$. The impact on land markets is reflected in an upward shift in the land demand from D_rD to $D_{rh}D$. The land market equilibrium shifts from (A_{1r}, r_{1r}) to (A_{1rh}, r_{1rh}). Land use and land rent increase by $A_{1rh}^* - A_{1r}^*$ and by $r_{1rh}^* - r_{1r}^*$, respectively.[16] Competition for land will drive up land rental prices. However, in region 2, where there is more land available than there are entitlements ($A_2^* > A_E^T$), there is no impact on the land market. The land market equilibrium remains at (A_2^*, r_2^*). Land rents do not change, nor does the land use. The SPS payments fully increase farm incomes. The SPS has a zero-distortive marginal effect on farm rental decisions in this region.

Reductions in the level of the SPS will have an opposite effect as the increase of the SPS. The level of t^r will decline and this may change land rents and land allocation, or not,

---

or downwards to bring them closer to the EU average level. More specifically, the national budgets of MS where the average payment (in EUR per hectare) is below 90% of the EU average are gradually increased (by one third of the difference between their current rate and 90% of the EU average). This convergence is financed proportionally by MS that have payment levels above the EU average level (EU 2013).

[16] Note that we do not exclude the possibility that the marginal land used to activate entitlements might be left uncultivated. The choice between using land in production versus leaving it uncultivated depends on the costs to keep it in good agricultural conditions required by the SPS eligibility (i.e. cross-compliance) relative to the costs of using it in production. Implicitly we assume that these costs are equal in our figures. For more detailed analysis on this issue see Courleux et al. (2008) and Kilian and Salhofer (2008).

depending on the ratio of entitlements to land rents. Consider a reduction of the SPS from t^r to t^{rl}, where $t^{rl} < t^r$. Land demand shifts downward from D_rD to $D_{rl}D$. In region 1, the land market equilibrium shifts to (A_{1rl}, r_{1rl}), land use reduces (by A_{1r}^* - A_{1rl}^*) and cause a fall in land rents (by r_{1r}^* - r_{1rl}^*). In region 2, the reduction in the SPS has no effect on the land market.

The impact of the SAPS budget change on the land market (not shown in Figure 2) is analogous to the effects shown for region 1 where there is a shortage of land compared to the amount of entitlements. The only exception is that there are no entitlements with the SAPS, meaning that all land qualifies for payments. Similar to region 1, the 2013 CAP reform increases land rent if the SAPS per hectare increases, whereas the capitalization decreases if the SAPS per hectare is reduced.

5.3. Internal convergence of payments (Reform II)

The 2013 CAP reform aims to eliminate or reduce the heterogeneity of per hectare payments that farmers receive in a region or MS. This concerns MS that implemented the historical SPS model or the static hybrid SPS model prior to the reform. Other schemes allocated flat-rate payments prior to the reform (i.e. the SAPS, the regional SPS model or the dynamic hybrid model that moved to a flat-rate) and thus are not subject to the convergence requirements. Member States could choose either to apply (i) a full convergence; or (ii) a partial convergence (European Commission 2015).

Under the full convergence, an equal per hectare payment is granted to all farms in a given region. This is similar to the regional SPS model or the SAPS implemented prior to the reform. MS could choose either to introduce flat-rate payment in the first year of the reform implementation (i.e. in 2015) or to introduce gradual harmonization of payments where the full convergence would be reached at least by 2019 or 2020 (European Commission 2015).

Under the partial convergence, the payment heterogeneity across farms is reduced but is not completely eliminated. The mechanism of partial harmonization consist of reducing payment rate to farms with higher value payments and increasing payment rate to farms with low value payments. More specifically, farms receiving less than 90% of the regional/national average rate are granted a higher value payment with the guarantee that the payment is not lower than 60% of the national/regional average. The increase in payments is financed by the farmers that get payments above the regional/national average. The amounts available to farmers receiving more than the regional/national average are reduced proportionally, with an option for MS to limit the maximum loss of 30% relative to pre-reform payments. Similar to the full convergence, MS may introduce the partial convergence in the first year of the reform implementation in 2015 or gradually by 2019 (European Commission 2015).

The convergence of the SPS within a country/region, when the historical or the static hybrid SPS models are replaced by the SPS entitlements that are partially or fully

harmonized, is likely to increase land rents (thus increase the capitalization of the SPS in land prices). The reason is that land rents (and the capitalization of the SPS) are determined at the margin and the demand for land will go up at the margin with harmonization of payments.

This is illustrated in Figure 3, which is extension of Figure 2. In Figure 2 we have the situation of a flat-rate model when all farms get the same SPS. In Figure 3 we introduce heterogeneity among farms in their entitlements – as for example the historic model does. Consider that there are two types of entitlements: high value SPS entitlements t^1 and low value SPS entitlements t^2. With tradability of entitlements, farms will first use the high-value entitlements, and then the low value entitlements.[17] This implies a land demand function such as represented by the (double kinked) curve D_hD. Relative to a no-support regime, the SPS shifts the land demand by t^1 up to A_E^1, where all high value entitlements are activated. In the interval from A_E^1 to A_E^T (where $A_E^T - A_E^1 = A_E^2$) it is higher by t^2, and it is the same after all entitlements are activated at A_E^T ($= A_E^1 + A_E^2$).[18]

To compare the effects of different SPS models, we keep the total amount (value) of the SPS entitlements constant. In previous sections we have shown that under the flat-rate model, the equilibrium was (A_{1r}^*, r_{1r}^*) in region 1 – where the land was binding, which is the more interesting case. Under the historical model the equilibrium in region 1 is (A_{1h}^*, r_{1h}^*). Hence, the land use will increase and land rents will go up with the shift from the historical to the flat-rate model. In Figure 3 we have considered a full convergence of payments by assuming a shift from the historical model to the flat-rate model. With a partial convergence (not shown in Figure 3), the impact on the land rent is still positive but smaller than with the full convergence and is proportional to the size of payment harmonization across farms.

In region 2, there is no effect of the harmonization. The SPS has no impact on the land market when there is more land available than entitlements. The equilibrium (A_2^*, r_2^*) remains the same with or without the harmonization of payments.

The introduction of the flat-rate model could increase the degree of the SPS capitalization also because it adds transparency to the land market. All entitlements have the same value within a region which could be observed by all market participants at zero costs. In contrast, with the historical/hybrid model the exact value of entitlements that farmers own may not be known by landowners, which may reduce their bargaining position with respect to farmers. This asymmetric information on entitlement values may reduce the capitalization in the historical model relative to the regional SPS model.

[17] Full tradability of entitlements implies that we can disentangle the entitlements from specific hectare of land or specific entitlement holder. Tradability of entitlements leads to a situation where first most valuable entitlements are exploited and are activated by farms with the highest willingness to pay for land renting and then less voluble ones are exploited (Ciaian, Kancs, and Swinnen 2008, Courleux et al. 2008 and Kilian and Salhofer 2008).

[18] Note that most MS implementing historical model have entitlements with a continuum of face values. See Killian et al. (2012) for modelling of this situation. Our assumption of two entitlements is to simplify the exposition of the effects and it does not affect the general results.

5.4. Differentiation of payments between farms (Reform III)

The 2013 CAP reform also includes several changes in decoupled payments, which may increase the differentiation in per hectare decoupled payments. The most important reform element that may induce higher variation in payments among farms is the redistributive payment. The redistributive payments aim at increasing the support for small and medium-sized farms by granting a higher payment value for the first 30 hectares (or up to the average farm size if higher than 30 hectares) than for the rest of the farm area. MS can allocate up to 30% of the decoupled payment budget for redistributive payments. This reform element effectively increases differentiation in per hectare payment value.

The impact of these reforms can be analyzed in the framework we used to compare the historical and the flat-rate SPS models – as illustrated by Figure 3. For a given (fixed) total amount (value) of the SPS, an increased differentiation will have a similar effect, as going from the flat-rate to the historic model. By differentiating the SPS per hectare adds "kinks" to the land demand function. The result is that at the margin the demand will be lower than in the case of more harmonized payments. Hence, these reforms will likely reduce land rental prices and capitalization.

Obviously this will be the case only in region 1 with surplus entitlements, where the SPS affects land markets.[19] In region 2 with deficit entitlements, the capitalization effects (where farms absorb the entire SPS) are the same in both cases; with and without Reform III.

Similar holds for the SAPS, where the differentiation of the hectare payments due to the redistributive payment reduces land rental prices and capitalization. The main intuition is similar to the SPS. Because only part of the farm's agricultural land receives the redistributive payment (up to a maximum defined), the marginal land is not affected by the higher payment and thus the demand at the margin will be lower than in the case of flat-rate payments.

5.5. Entitlement allocation (Reform IV)

A key factor that will impact the capitalization of subsidies is whether the new entitlement allocation will be different from the pre-reform allocation. If the reform will not affect the entitlement allocation, there will obviously be no effect. However, if the allocation of entitlements will be influenced by the current (or future) land use, then farms (i.e. entitlement applicants) could affect the amount of new entitlement by adjusting their land use. This would provide an opportunity for entitlement applicants to obtain entitlements for more land than they had before the reform.[20]

[19] The actual size of these effects will depend on the farm heterogeneity because the implementation of the Reform III largely depends on farm characteristics (e.g. farms size).

[20] In fact both types of reference periods were applied under the 2003 CAP reform. The number of hectares that generated support in the reference period (i.e. the pre-reform land use) was applied as the base for entitlement allocation in the historical model, while the land used in the first year of the SPS application was used as the base in the hybrid and regional models.

According to the 2013 CAP reform, the MS can choose (i) to maintain the old (pre-reform) entitlement allocation or (ii) to allocate new entitlements based on the eligible area in the first year of the reform implementation (i.e. in 2015) to farms which were eligible for direct payments in 2013. Under the first option, MS could impose additional restriction that the number of entitlements does not exceed the eligible area in 2015. Under the second option, MS could limit the allocated entitlements to the minimum between the eligible area in 2013 and the declared eligible area in 2015. Further, under both options MS could choose to allocate fewer entitlements for grassland (i.e. to apply the reduction coefficient) or to exclude land cultivated with vineyards and greenhouse. Alternatively, MS could grant new entitlements to farmers that were not eligible to receive direct payments under the old system (in 2013) such as vegetable producers, vineyards producers, etc. (European Commission 2016).[21]

The impact of the 2013 CAP reform on the SPS capitalization depends on whether it leads to the expansion of the entitlement stock or not. Obviously, in those MS where the old entitlement allocation is maintained, the capitalization effect of this reform element is zero, given that the stock of entitlement is not altered. An increase in the SPS capitalization may emerge in the second system of entitlement allocation. Under this allocation system, only those applicants who were eligible for direct payments in 2013 can receive new entitlements.[22] However, the reform does not restrict the number of entitlements that an applicant can obtain. Applicants can apply for a number of entitlements equal to their optimal land use (taking into consideration both the economic return from land and the entitlement value) given that the entire eligible area in 2015 qualifies for new entitlements.[23] This may lead to expansion of the number of entitlements relative to the eligible area and generate pressure on higher land rental prices on the land market.

The land market effects of the second system of entitlement allocation are shown in Figure 4. We consider the situation before the implementation of the 2013 CAP reform with uniform entitlements t^r, implying that the land demand is given by D_rD and the land market equilibriums are (A_{1r}^*, r_{1r}^*) and (A_2^*, r_2^*) in region 1 (represented by land supply curve S_1) and region 2 (represented by land supply curve S_2), respectively.

In a region where there are surplus entitlements in the pre-reform period (region 1 in Figure 4), the choice of the reference period may lead to a (small) reduction in land rents. The possibility to obtain new entitlements in the first year of the SPS implementation (in 2015 according to the reform) will incentivize farmers to obtain additional entitlements. The size of

[21] The requirement in this case is that applicant was farming in 2013. This requirement is not applied in Spain and Luxembourg.

[22] In some MS the farms eligible for receiving entitlement was extended to additional crops non-eligible in pre-reform period.

[23] Exceptions could be Belgium-Flanders, Ireland, Spain and Portugal which limit the allocated entitlements to the minimum between the eligible area in 2013 and the declared eligible area in 2015 which may lead to lower increase in the stock of entitlements relative to eligible area if substantial farm structural change took place between these two years.

the increase in entitlements will depend on the availability of land because, as defined in the 2013 CAP reform, farms will be allocated new entitlements only if they are accompanied by an equal amount of the eligible land. The 2013 CAP reform attempts to limit the increase of the number of entitlements. It stipulates that, if the total claims for entitlements increase by more than 35% of the total eligible area in 2009, MS can limit the number of payment entitlements to be allocated in 2015 to either 135% or 145% of the total number of eligible hectares in 2009 (EU 2013). However, because of more entitlements and a fixed budget, the per unit entitlement will decline (to t^N in in Figure 4), and hence land rents will decline. The land rent and the land use will decline from r_{1r}^* to r_1^N and from A_{1r}^* to A_1^N, respectively.[24] This effect is likely to be very small (unless there would be a very large increase in entitlements, which appears unlikely). If the entitlement stock does not change significantly (e.g. due to the land availability constraint or other reasons), the land market effects will be virtually zero.[25]

A larger change may occur in a region without the SPS capitalization (region 2 in Figure 4) because the amount of entitlements was less than the available land. An increase in entitlements could shift the ratio of entitlements/land to the point that the entitlement constraint is no longer binding and the SPS capitalization would increase. This is illustrated in Figure 4. The equilibrium land rents and land use increase from r_2^* to r_2^N and from A_2^* to A_2^N, respectively. A small increase in entitlements has a disproportional effect on land markets, as rents increase strongly because of the competition for land, which has intensified at the margin.

Our results suggest that Reform IV may have important implications for the SPS capitalization in those regions, where entitlements were in deficit in the pre-reform period. In regions with surplus entitlements, the SPS was already capitalized into land rents in the pre-reform period, implying that the reference period may have only small land market impacts and thus not crucial for the SPS capitalization. Note that the Reform IV does not concern the SAPS, as there are no entitlements under this subsidy allocation scheme.

5.6. 'Greening' of the CAP (Reform V)

The reformed CAP imposes a stronger linkage of decoupled payments to "agricultural practices beneficial to the climate and environment" (the-so-called *'CAP greening'*). The conditions are similar to cross compliance but more demanding than the cross-compliance requirements. Not respecting these requirements may lead to a reduction or a full loss of the SPS. Conceptually, the CAP 'greening' has similar implications for land markets as the cross-

[24] Visually Figure 4 shows a large increase of entitlements (an increase from A_E^T to A_E^N). However, this is only for illustrative purposes to reduce the complexity of the analysis. However, the results hold in general. In reality the increase in the number of entitlements will be likely smaller than visually apparent on the figure implying that A_E^N will be close to A_1^N in region 1 and A_E^N will be close to A_2^N in region 2.

[25] Analogously, if entitlement stock decreases in region 1, which is a less likely situation, the land use and land rents will increase.

compliance – a likely decline in land rents. An increase in environmental requirements will increase the costs for farmers, thus reduce profits from land use and hence reduce the demand for land. This, in turn, will lead to a reduction in the land use and a decline of land rents.

As already mentioned, the CAP 'greening' includes three measures: the crop diversification, the maintenance of permanent grassland and ecological focus area (set-aside). The 'greening' requirements may reduce land productivity, because they constrain farms with respect to the crop choice and the use of land. In the case of the crop diversification requirement, farms may be required to relocate land between crops, if they do not cultivate the required number of different crops, and if the maximum planting thresholds are not respected. Farms may need to cultivate a higher share of a less profitable crop to fulfil the crop diversification requirement. This would lead to a reduction of land profitability, and hence in lower farm bids for land rent. The implications of the permanent grassland requirement are similar. If it would be optimal for farm to convert grassland to other uses in the absence of the CAP greening, but the 'greening' requirement would constrain the farm from doing so, it may cause a downward shift in the land profitability. The ecological focus area requires farms withdrawing some land from production, which reduces returns from farming.

Reform V is illustrated in Figure 5 for the SPS with deficit entitlements.[26] Distance c represents the per hectare productivity reduction induced by the 'greening' requirements, it is assumed to be constant. The productivity reduction c shifts the land demand curve with entitlement t^r downward from D_rD to D_cD_c. The equilibrium shifts from (A^* r^*) to (A_c^* r_c^*). 'Greening' thus reduces the land use (by $A^* - A_c^*$) and the rental price (by $r^* - r_c^*$).

The evidence shows that the CAP ‘greening’ effects differ significantly between farms and regions due to the existing heterogeneity in farms' production structure, specialization, geographical location and technology. Some farms do not need to adjust to ‘greening’ requirements. This is the case, for example, if their production structure is already sufficiently diversified, if they have no incentive to convert grassland to other uses, or if they possess strips of land economically not suitable for production. For some other farms, in particular those specialized in growing a single crop without fallow land, an adjustment in production structure is required. This implies, that the ’greening’ impact will vary between the MS, regions and farms (Louhichi et al. 2015; Solazzo et al. 2014; Cimino, Henke and Vanni 2015).[27] At the aggregate MS or regional level, the existing evidence shows that the impact of the CAP greening on the farm performance (productivity, income) – on c as shown in Figure 5 – is rather small (Louhichi et al. 2015; Was et al. 2014; Solazzo and Pierangeli 2015). Further, the evidence suggests that the impact of CAP greening may actually induce small income increase at the aggregate MS or the regional level, if a positive output price

[26] Similar intuition holds for SAPS.

[27] This also implies that the productivity reduction, c, may not be constant as assumed in Figure 5 but may change (increase or decrease) with land use.

feedback is taken into account.[28] The farm income may increase because the CAP greening leads to a productivity decline which in turn reduces production level causing higher output prices (Gocht et al. 2015). Overall, the evidence from the previous literature implies that the impact of the CAP greening on the decoupled payment capitalization will likely be minimal, as the productivity decline may be partially or fully offset by an output price increase and thus difficult to be detected and measured in practice.

6. Estimation of the capitalization effects of the reform

In this section we aim to quantify the capitalization effects of the 2013 CAP reform in land rental prices, as well as we decompose the contribution of each reform element to the total post-reform capitalization level. The capitalization effects are quantified by MS by taking into account the variation of the actual implementation of the reform. Note that the size of the effects quantified in this section is indicative and should be interpreted with care, as there are insufficient data to econometrically estimate the actual impact of the reform. The results presented in this section indicate the potential direction of the capitalization change and provide the expected pressure that the reform may induce on the EU land markets.

6.1. Methodology

We estimate the capitalization of decoupled payments into land rental prices for both the pre-reform period and the post-reform implementation. Alongside providing the total capitalization effects, this approach allows us to quantify the change in capitalization caused by the CAP reform. To derive the post-reform capitalization we consider all reform elements as discussed in section 5, with the exception of the CAP greening. The main motivation for excluding the CAP greening is that its impact on the agricultural market (production and income) is found to be rather small in the literature (e.g. Louhichi et al. 2015; Gocht et al. 2015; Was et al. 2014; Solazzo and Pierangeli 2015), and thus it is expected to have an insignificant impact on land markets. Consistent with the conceptual model of the previous section, we consider full adjustment of land markets to the decoupled payment changes.

In section 5 we have shown that the SPS is capitalized in land rents if entitlements are in surplus relative to the eligible area. For the SAPS there are no entitlements and the entire farmland area is eligible for receiving payments, implying that at the margin it always affects land rents. In both cases the capitalization level is determined by the marginal entitlement value.

Literature suggests that the capitalization of decoupled payments is strongly determined by land demand and supply elasticities (Floyd 1965; Guyomard et al. 2004; Ciaian and Kancs 2012). Following our conceptual model, the capitalization formula for the

[28] Note that our conceptual analysis showed in Figure 5 assumes fixed output prices.

pre-reform period (indexed with *O*) for the SAPS or for the SPS, if entitlements are in surplus, $A^T \geq A^*$, can be derived as follows (see Appendix 1):

(1) $$\left.\frac{\Delta r}{t_{av}}\right|_O = \frac{-\eta^D}{\eta^S - \eta^D}\frac{\Delta t_m}{t_{av}} = K\frac{\Delta t_m}{t_{av}}$$ for SAPS or for SPS if $A^T \geq A^*$

where t_m is the marginal value of the decoupled payment, t_{ac} is the average value of the decoupled payment, η^S and η^D are the land supply and land demand elasticities, respectively, with $\eta^S = (\Delta S/\Delta r)(r/S)$ and $\eta^D = (\Delta D/\Delta r)(r/D)$, and K is the capitalization parameter which determines how much one Euro of decoupled payments is capitalized into land rental prices, $K = -\eta^D/(\eta^S - \eta^D)$.

Equation (1) estimates the average pre-reform capitalization rate of decoupled payments for the SAPS or for the SPS if entitlements are in surplus. It indicates how much (% share) one Euro of decoupled payments is reflected in higher rental prices. The average capitalization rate decreases with land supply elasticity and increases with land demand elasticity. For example, in an extreme situation with fully inelastic land supply, $\eta^S = 0$, the marginal decoupled payment is fully capitalized in land rents, i.e. $K = 1$.

Note that to derive the average capitalization rate with equation (1), one needs to consider the marginal value of decoupled payments, if decoupled payments vary across farms. For example, for the historical SPS model shown in Figure 3, the marginal entitlement value is equal to t^2, $t_m = t^2$, whereas for the flat-rate SPS model shown in Figure 3, the marginal entitlement value is equal to the average payment value t^r, $t_m = t_{av} = t^r$. Similar to the regional SPS model, for the SAPS the marginal payment value is equal to the average payment value.

The capitalization formula for the 2013 CAP reform (indexed with *N*) can be derived as follows (see Appendix 1):

(2) $$\left.\frac{\Delta r}{t_{av}}\right|_N = K\left(\frac{\Delta t_m^I}{t_{av}} + \frac{\Delta t_m^{II}}{t_{av}} + \frac{\Delta t_m^{III}}{t_{av}} + \frac{\Delta t_m^{IV}}{t_{av}}\right)$$ for SAPS or for SPS if $A^T \geq A^*$

where $\Delta t_m{}^I$, $\Delta t_m{}^{II}$, $\Delta t_m{}^{III}$ and $\Delta t_m{}^{IV}$ are changes in the marginal value of decoupled payments due to the first, the second, the third and the fourth reform elements, respectively.

Equation (2) decomposes the contribution of the individual reform elements in the total change of the average capitalization rate for the SAPS or for the SPS, if entitlements are in surplus. We use the pre-reform capitalization formula (1) and the post-reform capitalization formula (2) to quantify the total post-reform capitalization rate as well as the relative importance of the different reform elements in the general post-reform average capitalization rate (see Appendix 1).

The expected SPS capitalization rate for the case of deficit entitlements is zero: $\Delta r/\Delta t_{av} = 0$. This follows form the conceptual model illustrated in Figure 2 and Figure 3. The SPS has a zero-distortive marginal effect on farm rental decisions when there are insufficient

entitlements relative to eligible area. This result is not affected by the SPS model applied in the pre-reform period (e.g. historical, hybrid or regional models) or by the four reform elements, as long as the stock of entitlements remain in deficit relative to the eligible area.

6.2. Data and variable construction

Table 6 and Table 7 show the *budgetary allocation of direct payments* and the *implementation of decoupled payments* before and after the reform. This information is used for the quantification of capitalization effects derived in equations (1) and (2). For the 2013 CAP reform we consider decoupled payments as implemented in 2019, as this reflects the final situation when the full adoption of the CAP reform takes place. For the pre-reform situation we consider the year 2013, which is the last year when the pre-reform CAP system was in place.

According to the data reported in Table 6, the total EU-27 CAP budget allocated to direct payments in 2019 represents 41.5 billion Euro, decreasing by 8% relative to 2013.[29] Note that direct payments include both coupled and decoupled payments. The budget for decoupled payments decreased less for EU-27 level (by 4%) over the same period indicating that the relative importance of decoupled payments compared to coupled payments increased in the total direct payment envelope. At the MS level, the decoupled payments' budget increases in many NMS (with exception of Cyprus, the Czech Republic, Malta and Slovenia) in 2019 relative to 2013. In contrast in most OMS the decoupled payment budget reduces; the exceptions are Austria and Portugal. This change in decoupled payment budget between 2013 and 2019 is caused by the combination of four factors: the external convergence, the relocation of the direct payment budget between coupled and decoupled subsidies, the transfer of resources between direct payments and other CAP items (RDP) and the overall CAP budget reduction. OMS have higher payments per hectare than NMS, as a result of which the implementation of the external convergence tends to decrease payments in former countries to the benefit of latter countries. Other main reason for the observed divergent development of decoupled payment budget is that many NMS transfer resources from other CAP items (RDP) to the direct payment envelope, whereas several OMS do the reverse. Finally, the decoupled payment budget also reduces, because of the overall CAP budget cut.

Table 7 reveals that in general, MS implementing a hybrid SPS model before the reform introduced the flat-rate SPS system in the post-reform period, while MS implementing the historical SPS model opted to keep differences in decoupled payments among farms by implementing a partial convergence. Overall, out of 18 MS implementing the SPS before the reform, four countries apply a flat-rate (either at the regional or the national level) starting from 2015 (Fance-Corsica, Malta, UK- England), five gradually introduce a flat-rate by 2019 or 2020 (Austria, Finland, Germany, the Netherlands and UK - Scotland and Wales), whereas

[29] Note that the direct payments for EU-28 decreased less (7%) because Croatia is not accounted in the 2013 data as it was not EU member country, whereas it is included in the 2019 data.

the rest of these MS (14) apply a partial convergence by 2019. Member States that applied the SAPS before the reform continue to apply the SAPS, which is a flat-rate area payment scheme and does not require adoption of the internal convergence. Also Germany,[30] Malta, and UK-England had a flat-rate SPS system before the reform and thus these countries are also not concerned by internal convergence. In contrast, Slovenia had a flat rate payment before the 2013 CAP reform, while after the reform payments are differentiated across farms (European Commission 2015).

In total, nine Member States implement the redistributive payment: Belgium (Wallonia only), Bulgaria, France, Germany, Croatia, Lithuania, Poland, Romania and UK (Wales), accounting from 5% of the direct payment budget in Romania to 20% in France. The maximum area per farm receiving the redistributive payment varies between 20 hectares in Croatia to 54 hectares in UK-Wales (Table 7).

Most MS adopted an entitlement allocation mechanism under which they replace old entitlements with new ones. Only four MS decided to maintain the exiting (old) entitlements. Additionally, Austria and UK-Scotland have applied a reduction coefficient to permanent grassland (1 hectare of permanent grassland gives right to 0.2 entitlements in Austria and 0.9 in UK-Scotland) (Table 7).

The numbers of activated entitlements in the pre-reform period (2013) are available from the European Commission and are reported in Table 8. The eligible area for 2013 is also available from European Commission and is calculated based on a combination of CATS-database data (DG-AGRI) and Farm Structure Survey (FSS) data. For the post-reform period, the eligible area is calculated based on the eligible area in 2013 by adding (deducting) areas made eligible (ineligible) under the reform (e.g. vineyards in France and greenhouses in the Netherlands and Greece were made ineligible). To obtain the post-reform SPS entitlements, first we calculate the ratio of entitlements to the eligible area-based on the 2012 FADN data and then multiply this ratio with the eligible area in post-reform period to obtain the number of entitlements.

We use the ratio of entitlements to eligible area to determine whether the SPS impacts land rents at the margin. MS with activated entitlements equal or higher (lower) than 97% of eligible area where assumed to have surplus (deficit) entitlements[31] representing the situation when the SPS impacts (does not impact) the land market.[32] This threshold is used to derive

[30] Germany implemented the hybrid SPS model at the regional level in the pre-reform period, whereas in the post-reform period it implements the flat-rate SPS model at the national level. Note that this change in the SPS implementation from regional to national is not taken into account in our estimations, as we conduct a country level analysis and not at the regional level.

[31] The main reason for considering 97% instead of 100% threshold is that the available data on entitlements for calculating this ratio was based on the activated (used) entitlements and not on the total disbursed entitlements which may underestimate their total stock as some of them might be unused.

[32] This assumption is partially supported by empirical studies estimating the capitalization of the pre-reform SPS. Although conclusive evidence cannot be derived from the available empirical studies, the empirical studies tend to find a higher capitalization rate in regions with surplus entitlements compared to regions with deficit entitlements of the pre-reform SPS. For example, Johansson and Nilsson (2012) analyze the SPS impacts in Sweden, and Kilian et al. (2012) analyze the SPS impacts in Bavaria (Germany) and find a comparably high

the mean (central) average capitalization rates of decoupled payments. We consider lower and upper variation between ±2% of this threshold to account for the uncertainty in the underlying data[33] and which will determine the interval within which the capitalization rate may vary.

Key parameters required to quantify the capitalization rate as defined by equations (1) and (2) are *marginal* and *average values of decoupled payments*. The average payment value is obtained by dividing the total decoupled envelope reported in Table 6 by the number of entitlements for the SPS and by the total eligible area for the SAPS. As Table 8 shows, the average payment value in the pre-reform period (2013) varies between 73 Euro/ha and 713 Euro/ha. In the post-reform period (2019) the variation decreases to between 128 Euro/ha and 366 Euro/ha.

The marginal payment values are calculated first for Reform IV and then are consecutively adjusted in line with Reforms I, II and III (Table 8).[34] The marginal payment value of the entitlement stock change effect (Reform IV) is set to the pre-reform marginal decoupled payment value adjusted by the change in the stock of entitlements for the SPS (i.e. by keeping the decoupled payment budget unchanged at the pre-reform level, while changing the stock of entitlements caused by the reform). The marginal payment value for the budget change effect (Reform I) is obtained by adjusting the marginal payment value of Reform IV by the rate of change of the decoupled payment budget in 2019 relative to 2013 reported in Table 6. MS that a have lower decoupled payment envelope in 2019 than in 2013 experience a reduction in the marginal payment value due to Reform I, whereas the reverse is observed for MS with a budget increase. The marginal payment value for the internal convergence effect (Reform II) is obtained by adjusting the marginal payment value of Reform I by setting it to the 2019 average decoupled payment value for the SAPS and for the flat-rate SPS model. For the SPS model with heterogeneous payments across farms, the marginal payments for Reform II are calculated based on FADN data for 2012. For the pre-reform period we use the distribution of decoupled payments across farms as available in the actual 2012 FADN data. For the CAP reform, we calculate new decoupled payments following the EU regulation (EU 2013). Then, to obtain the marginal value (for both the pre-reform and the post-reform period), we take the average decoupled payment value of 2% of farms with lowest payment values. Finally, the marginal payment value for the differentiation of the payments effect (Reform III) is obtained by adjusting downward the marginal payment value of Reform II by the relative share of redistributive payments in the total value of decoupled payments.

capitalization rate. In contrast, Michalek, Ciaian, and Kancs (2014) find that the capitalization rate is lower in those regions, where the entitlement/UAA ratio is lower. Similarly, Guastella et al. (2014) find a statistically insignificant impact of the SPS on land rents in Italy, which has deficit entitlements.

[33] Note that the derived capitalization rate is inversely correlated with the threshold level.

[34] Note that if the order of the marginal payment values calculation changes, the contribution of the different reform elements may change. The key determinant of the capitalization is the stock of entitlements relative to the eligible area. Changing the order of this element will change the contribution of the other reform elements. However, the overall capitalization rate will not be altered.

Following the conceptual analysis, this consideration assumes that the redistributive payment is financed proportionally by reducing decoupled payments across all farms, while farms receive a top-up redistributive payment which does not affect marginal decoupled payment as depicted in Figure 3. Note that, following the conceptual analysis, the marginal values in Table 8 always affect land rents for the SAPS, whereas for the SPS only if entitlements are sufficient (above 97% or ±2% variation around this central value) relative to the eligible land.

Finally, to derive the capitalization parameter, *K*, in equations (1) and (2), *land supply and demand elasticities* are extracted from the literature. We use central values of elasticities to derive the mean (central) average capitalization rates of decoupled payments. We also extract lower and upper values of elasticities form the literature to indicate the interval within which the capitalization may vary. This accounts for the fact that land availability and land demand behavior may vary across EU regions. In empirical studies, *land supply elasticities*, η^S, are usually found to be rather low, mostly owing to natural constraints. The most commonly estimated values of output supply elasticities are between 0.1 and 0.6 (e.g., Salhofer 2001; Abler 2001). Based on an extensive literature review, Salhofer (2001) concludes that a plausible range of land supply elasticity for the EU is between 0.1 and 0.4. Similarly, Abler (2001) finds a plausible range between 0.2 and 0.6 for the US, Canada and Mexico. Following Salhofer (2001) we use the central estimate of land supply elasticity of 0.25, and the lower and upper bounds at 0.1 and 0.4, respectively. We use central estimate of *land demand elasticities*, η^D, of -0.875 with a variation between -0.8 and -0.95 (see Appendix 2).

6.3. Results

Table 9 and Table 10 report the results for the capitalization effects of the 2013 CAP reform. As mentioned above, the estimated magnitudes of the effects are indicative and should be interpreted with care, as there are insufficient data to econometrically estimate the actual size of the effects. Table 9 reports the capitalization rate. Columns 2-4 show the pre-reform capitalization rate of decoupled payments by providing average (central) estimates as well as an uncertainty interval which provides the lower and upper bounds of the estimates. Columns 5 to 7 summarize the expected capitalization of the 2013 CAP reform. Table 10 shows the decomposition of capitalization sources of the 2013 CAP reform[35] accounting in column 2-4 for the contribution of the pre-reform capitalization, in columns 5-7 for the entitlement stock change (Reform IV), in columns 8-10 for the total budget change (Reform I), in columns 11-13 for the internal convergence of payments (Reform II) and in columns 14-16 for the differentiation of payments (Reform III).

[35] Croatia is not considered in the decomposition of the post-reform capitalization effects as it was not part of the EU in the pre-reform period and thus we do not have a counterfactual pre-reform situation for the decoupled payment implementation.

The first major observation arising from Table 9 is that the capitalization rate of decoupled payments is affected by the 2013 CAP reform vis–à–vis the pre-reform period. At the EU level, the reform increases the central value of the capitalization rate from 31% to 47%. The lower and upper bounds (i.e. the uncertainty interval) of the average capitalization rate in the pre-reform period is between 15% and 43% increasing to between 40% and 55% in the post-reform period. These results imply that the CAP reform causes the rental price of farmland to increase by additional 16 euro cents spent on decoupled payments relative to the pre-reform situation with lower and upper bounds being 11 cents and 25 cents, respectively.

The main source of post-reform capitalization in EU reported in Table 10 is the pre-reform capitalization accounting for 69% of the total post-reform capitalization, followed by the entitlement stock change (Reform IV) with 19%, internal convergence (Reform II) with 18%, the budget change (Reform I) with 1%, whereas the differentiation of payments (Reform III) contributes to the reduction of the post-reform capitalization by accounting for -7% of the total post-reform capitalization rate. The uncertainty analyses show that the contribution of the pre-reform capitalization and the entitlement stock change (Reform IV) may vary significantly 39%- 85% and 3%-49%, respectively). This variation is caused by the ±2% threshold used for determining when the entitlement stock relative to the eligible area is large enough so that SPS affects willingness to pay for land renting at the margin. Because the pre-reform capitalization and the post-reform capitalization caused by the entitlement stock change (Reform IV) are inversely correlated, they change considerably and in an opposite direction when altering this threshold.

Our results suggest a significant difference in the capitalization rate between NMS and OMS. The capitalization rate is higher in NMS than in OMS in both the pre- and post-reform periods: 76%-72% in NMS versus 20%-39% in OMS (Table 9, Figure 6). This is because most MS implement the SAPS which, according to our conceptual analysis, has a stronger impact on land rents than the SPS. Our estimated capitalization rate for NMS is higher than the empirically estimated in Ciaian and Kancs (2012) and Van Herck, Swinnen and Vranken (2013). However, these studies base their estimations on the data from the first years of the SAPS implementation, when the effects might have not fully materialized yet due to land market rigidities (e.g. long duration of rental contracts). Our estimated capitalization rate for OMS are largely in line with the literature which tends to find a lower capitalization of the SPS, although, with some heterogeneity across MS (e.g. Michalek, Ciaian and Kancs 2014; Feichtinger and Salhofer 2015a; O'Neill and Hanrahan 2016).

A further important difference between NMS and OMS is that the reform slightly reduces the capitalization rate in NMS, whereas it increases in OMS. In NMS the central value of the capitalization rate reduces from 76% in the pre-reform period to 72% in the post-reform period. In OMS the central rate almost doubles from 20% to 39% (Figure 6). The main reason for this difference in the reform effects is that most NMS have the SAPS in place in both periods which exerts a strong impact on land markets. This is reflected in the fact that

the main source of the post-reform capitalization is the pre-reform capitalization accounting for 91% of the total post-reform capitalization, whereas the 2013 CAP reform accounts only for 9%. These figures imply that the changes introduced to decoupled payments by the reform in NMS do not significantly alter incentives on the land market and keep the capitalization level largely unchanged. In OMS the pre-reform capitalization accounts significantly less (56%) of the total post-reform capitalization, whereas the reform captures the remaining 44% of the post-reform capitalization rate. The uncertainty analyses show that the reform contribution to the total post-reform capitalization vary between 20% and 90%. This variation is driven by the entitlement stock change (Reform IV) which varies between 3% and 75%, as it is inversely correlated with the contribution of the pre-reform capitalization. The most important reform element causing the increase in the capitalization in OMS is the internal convergence (Reform II), 29%, followed by the entitlement stock change (Reform IV), 28%. Most OMS allocate new entitlements, which leads to an expansion of the stock of entitlements relative to the eligible area which turns many OMS with a zero capitalization rate in the pre-reform period to a positive capitalization in the post-reform period. However, as indicated above the uncertainty analyses suggest that the contribution of Reform IV may vary between 3% and 75%. The internal convergence increases payments at the margin, inducing an upward pressure on land rents. The other two reform elements (Reforms I and III) reduce the capitalization rate in OMS (by -5% and -8%, respectively), but they do not offset the effects of the latter two reforms (Reforms II and IV) (Table 10, Figure 7).

As expected, the budget change (Reform I) increases capitalization in NMS (11%) while it decreases in OMS (-5%) (Table 10). As explained above, this is caused by external convergence, which aims to partially harmonize payments across MS. Given that OMS have higher payments per hectare than NMS, the external convergence decreases payments in OMS to the benefit of NMS. Another important reason for the observed divergent development of the decoupled payment budget is that many NMS transfer resources from other CAP items (RDP) to the direct payment envelope, whereas several OMS do the reverse. These changes expand payment values in NMS and contract them in OMS. Further, as expected the entitlement stock change (Reform IV) and the internal convergence (Reform II) contribute minimally to the post-reform capitalization in NMS in contrast to OMS. This is because most NSM implement the SAPS, which is a flat-rate payment scheme without entitlements. Hence, these two reforms do not concern these countries (Table 10).[36]

The strongest increase in the capitalization rate occurs in MS which allocated new entitlements (Reform IV) in the post-reform period (Table 9). This includes MS implementing the historical SPS model in OMS and the regional SPS model in NMS in pre-reform period. The main explanation for this result is that these MS had deficit enlistments

[36] This two reforms elements concern only Croatia, Malta and Slovenia which are the only three NMS implementing the SPS.

relative to the eligible area in the pre-reform period which implies a zero capitalization. Allocation of new entitlements led to their expansion relative to the eligible area, given that their allocation is based on the land use in the first year of the reform implementation. The post-reform stock of entitlements become approximately equal to total eligible land use (i.e. with optimal land use), which leads to a stronger land competition, as land is needed for the activation of entitlements and thus induces the SPS to raise land rents in these MS. This entitlement stock effect (Reform IV) causes the capitalization to increase from zero in the pre-reform period to a positive capitalization in the post-reform period. The exceptions are Austria and Spain, where the capitalization is zero in both pre- and post- reform periods. Austria has applied a reduction coefficient to the permanent grassland. Spain limited the allocated entitlements to the minimum between the eligible area in 2013 and the declared eligible area in 2015, as well as there are no extension of eligible farms (i.e. entitlements were allocated in the post reform-period only to those farms which were eligible to receive direct payments in 2013). Both these implementation details reduced the stock of entitlements relative to the eligible area and thus reduced the pressure of decoupled payments on the land market.[37]

For most MS which implemented the hybrid SPS model in the pre-reform period, the capitalization effect was positive in the pre-reform period, hence the entitlement stock effect (Reform IV) has a minimal impact in the post-reform period even though most of these MS keep the old entitlements. The exceptions are Luxemburg and UK (Table 9). These two countries had a zero central value of the capitalization rate in the pre-reform period, while the allocation of new entitlements (in Wales and Northern Ireland in UK) based on the land area in the first year of the reform implantation caused expansion of entitlements and a positive central capitalization rate in the post-reform period. Note that even though the pre-reform central capitalization rate is zero in these two MS, the upper bound of the capitalization rate is positive at 27% in Luxemburg and 90% in UK suggesting that the change obtained for the central rate in the post-reform period might be lower.

The internal convergence (Reform II) contributes significantly to the post-reform capitalization, particularly in MS with the historical SPS model in the pre-reform period (Belgium, Greece, France, Ireland, Italy, Netherlands, Portugal) and in MS with the hybrid SPS model in the pre-reform period that fully harmonized payments across farms in the post-reform period (Finland) (Table 10). The internal convergence increases payment values at the margin which causes a greater share of payments being reflected in higher rental prices. However, the highest post-reform capitalization rate is observed in MS that have introduced a full convergence or have a flat-rate payment scheme (i.e. in Germany, Finland, the

[37] Note that similar to Spain, Ireland and Portugal have also limited the allocated entitlements to the minimum between the eligible area in 2013 and the declared eligible area in 2015. However, no significant changes in land use took place between 2013 and 2015 implying that allocation of new entitlement caused that the stock of entitlement correspond to eligible area in post-reform period.

Netherlands, Sweden, UK, NMS with the SAPS), whereas MS that have partially harmonized decoupled payments (those with partial convergence) have a significantly lower capitalization level. This is because the former MS have greater relative value of the per hectare marginal payments (relative to the average per hectare payment) than the latter MS causing a higher capitalization level.

As expected, the differentiation of payments (Reform III) leads to a reduction of capitalization in all MS that implement it and have a positive capitalization rate (Belgium, Bulgaria, France, Germany, Lithuania, Poland, Romania, UK). Its importance in the total post-reform capitalization rate varies between -7% and -31% across MS (Table 10).

All NMS implementing the SAPS have a relatively high capitalization rate before and after the reform. This is because of the nature of the SAPS under which all eligible area receives payments and thus exercises a strong upward pressure on land rents in both periods (Table 9). This explains why the contribution of the pre-reform capitalization is by far the most important source of the post-reform capitalization in NMS. In the pre-reform period the central value of the capitalization rate is 78% in all NMS implementing the SAPS. In the post-reform period it decreases only in four NMS (to 72% in Bulgaria, 64% in Lithuania, 70% in Poland and 73% in Romania), while in the rest of NMS it stays unchanged. The reduction in the capitalization rate occurs in NMS implementing the differentiation of payments (Reform III), because this reform element reduces the value of marginal payments and introduces some SAPS heterogeneity across farms (Table 9, Table 10).

The impact of the budget change (Reform I) is heterogeneous among MS depending on the direction and magnitude of the decoupled payment envelope change. However, in most NMS Reform I contributes positively to the post-reform capitalization, given that the decoupled payments' budget increases in many NMS between 2013 and 2019. In contrast, in most OMS the decoupled payment budget reduces; hence the contribution of the Reform I to the post-reform capitalization tends to be negative. The contribution of Reform I to the post-reform capitalization varies between -13% and 2% in OMS. In NMS its contribution is greater by varying between -137% and 43% (Table 10).

Non-farming land owners' policy gains

Based on the estimated capitalization rates in Table 9 and using the FADN data on land renting, we can calculate the non-farming landowner gains from decoupled payments in pre- and post-reform periods for every MS as well as aggregated for NMS, OMS and the EU. In this exercise we assume that the share of the rented farmland in the post-reform period (2013) is the same as in the pre-reform period. The results are reported in Table 11 showing central values as well as lower and upper bounds. The capitalization rate reported in Table 9 represents the subsidy gain for all landowners (both for farming and non-farming), whereas non-farming landowner gains in Table 11 represent policy benefits only for those landowners, who are not involved in farming.

On average, 25% of decoupled payments are channeled to non-farming landowners through higher rental prices in the EU in the post-reform period, increasing from 17% in the pre-reform period (Table 11, Figure 8). This non-farming landowners' capitalization rate is 54% of the capitalization rate reported in Table 9. Given that the land renting rate is around half of the used land in both NMS and OMS, the non-farming landowners gains are roughly half of the capitalization rate reported in Table 9 and Figure 8 at 39% and 21%, respectively, in the post-reform period, changing form 41% and 11%, respectively, in the pre-reform period.

The highest post-reform leakages of decoupled payments to non-farming landowners are in Slovakia, Malta, the Czech Republic and Bulgaria, where non-farming landowners gain between 60% and 73% of the total decoupled payment value. These MS have a high share of land renting as well have in place flat-rate payment scheme. They are followed by Estonia, Cyprus, Croatia, Germany, Hungary, Latvia, Lithuania, the Netherlands, Romania and UK, where between 30% and 60% of decoupled payments flow to non-farming landowners. These countries have sizable land renting and similar to the first group of countries (with the exception of Croatia), have implemented a flat-rate payment scheme. In Belgium, Denmark, Greece, Finland, France, Ireland, Italy, Luxemburg, Portugal, Poland, Sweden and Slovenia the leakages are between 6%and 30% of the total decoupled payment value. These MS have either small land renting (e.g. Poland; Finland), have heterogeneous payments (have adopted partial convergence of payments) (e.g. Belgium, France), or have combination of both factors (e.g. Ireland, Portugal). In the rest of the courtiers (Austria, Spain), non-farming landowners have zero post-reform gains because of a zero capitalization rate (Table 11).

7. Conclusions

The objective of this paper is to analyze the impact of the 2013 CAP reform on the decoupled payment capitalization into land values in the EU. Compared to previous studies, we account for the actual implementation of the CAP reform across MS and decompose the contribution of different reform elements to the total post-reform capitalization level. We consider the key reform elements that may impact incentives on land markets and thus cause changes in the capitalization level, including the harmonization of payments between farms (internal convergence), the differentiation in per hectare payments (redistributive payment), changes in the reference period for entitlement allocation, budgetary changes and the partial harmonization of payments across MS (external convergence), and the CAP greening.

Our results suggest that, on average in the EU, the reform leads to a 47% capitalization rate of decoupled payments into land rents increasing from 31% in the pre-reform period. These results imply that the reform causes land rental prices to increase by additional 16 cents for each EUR of decoupled payments relative to the pre-reform situation. Our results suggest a significant difference in the impact of the CAP reform in NMS and OMS. The reform slightly reduces the capitalization rate in NMS, whereas it increases in

OMS. In NMS the capitalization rate slightly reduces from 76% in the pre-reform period to 72% in the post-reform period. Although the capitalization rate is significantly lower in OMS, it almost doubles due to the reform: from 20% to 39%. The main reason for this difference is that decoupled payments are capitalized in NMS already in the pre-reform period, as most of NMS countries implement the SAPS which exerts a stronger pressure on the land market than the SPS implemented in OMS.

The main source of the post-reform capitalization in the EU is the pre-reform capitalization accounting for 69% of the total post-reform capitalization, followed by the entitlement stock change with 19%, the internal convergence with 18%, the budget change with 1%, and the differentiation of payments with -7%. Again, there is a significant difference between NMS and OMS. Because decoupled payments were capitalized in NMS already in the pre-reform period, the pre-reform capitalization accounts as much as 91% of the total post-reform capitalization in these countries. The reform only marginally impacts land rents; it explains 9% of the total post-reform capitalization. In contrast, in OMS the reform causes 45% of the total post-reform capitalization with the largest drivers being the internal convergence (29%) and the entitlement stock change (28%). The other two reform elements - the differentiation of payments and the budget change - reduce the post-reform capitalization in OMS but are of much smaller importance - accounting for -8% and -5%, respectively, of the total post-reform capitalization.

Based on the estimated capitalization rate and the FADN data on the share of rented land, we have calculated the non-farming landowners' gains from decoupled payments. On average, 25% of decoupled payments are channeled to non-farming landowners in the EU in the post-reform period, increasing from 17% in the pre-reform period. The same figures for NMS and OMS are 39% and 21%, respectively, in the post-reform period changing form 41% and 11%, respectively, in the pre-reform period. These results suggest a relatively small to moderate leakage rate of decoupled payments to non-farming landowners. In 2019, the total value of the decoupled payment budget represents around €37 billion in the EU. If we consider a 25% leakage rate of decoupled payments to non-farming landowners (Table 11), around €9.3 billion per year are expected to be channeled outside the farming sector in the EU in the post-reform period of which €3.2 billion is caused by the reform, whereas the rest, €5.1 billion, is due to the pre-reform capitalization.

Despite the comprehensiveness of the analysis, one should interpret the results reported in this paper with care, as there are several factors that do not allow predicting capitalization effects with the desired accuracy. This paper provides theoretical effects that the reform may induce on the EU land markets; the actual impact will depend on many other factors. First, we have assume a full land market adjustment to the 2013 CAP reform, which in reality may not hold in the short-run, and the rental price response may take longer time due to various land market imperfections and rigidities. Second, although we have attempted to account for uncertainties in our approach by providing lower and upper bounds of

capitalization estimates, the reform effects might be even more complex and might be co-determined by local factors and regional land market characteristics. This implies that capitalization effects of the CAP reform may differ not only between MS, but also across regions within a MS. Third, we have assumed a full tradability of the SPS entitlements in our analysis. In reality, the entitlement tradability might be constrained due to market imperfections or a policy risk, and thus alter the estimated capitalization level. A conceptual analysis of Ciaian, Kancs, and Swinnen (2008) has shown that in such a situation the capitalization level of the SPS might be higher compared to a full tradability as assumed in this paper. Fifth, in our analysis we have not taken into account the pressure on the capitalization level coming from new entrants into the agricultural sector. MS can create a reserve of up to 3% of the decoupled payment envelope, where priority for the allocation of entitlements is given to young farmers and new entrants. This effect may enhance the capitalization effect but it depends on its magnitude and frequency of use. Sixth, land prices are strongly impacted by commodity price developments and thus when conducting empirical analyses they need to be controlled for otherwise they may confound with the CAP reform impacts. Finally, decoupled payments are subject to future adjustments and reforms, implying that the capitalization of the 2013 CAP reform will also depend on the perception of farms and landowners about certainty and stability of the new legislation in the medium to long-run. Despite these limitations, the paper shows the potential implications of the 2013 CAP reform and in particular it indicates the pressures that it may generate on land markets in the EU.

8. References

Abler, D. 2001. Elasticities of Substitution and Factor Supply Elasticities in Canadian, Mexican and United States Agriculture: A Review of Past Studies. OECD Market Effects of Crop Support Measures, OECD, Paris, pp. 57-88.

Alston, J.M. and J.S. James. 2002. The Incidence of Agricultural Policy. In *Handbook of Agricultural Economics, Volume 2B,* eds. B. L. Gardner and G.C. Rausser, 1689-1749 Amsterdam: Elsevier.

Breustedt, G. and H. Habermann. 2011. The Incidence of EU Per-Hectare Payments on Farmland Rental Rates: A Spatial Econometric Analysis of German Farm-Level Data. *Journal of Agricultural Economics* 62(1): 225–243.

Ciaian, P. and D. Kancs. 2011 The Impact of Market Imperfections on Heterogeneous Firm Output, Productivity, and Profit. *Journal of Rural Cooperation* 39(1); 49–72.

Ciaian, P. and D. Kancs. 2012. The Capitalisation of Area Payments into Farmland Rents: Theory and Evidence from the New EU Member States. *Canadian Journal of Agricultural Economics* 60(4): 517–540.

Ciaian, P. and J.F.M. Swinnen. 2006. Land Market Imperfections and Agricultural Policy Impacts in the New EU Member States: A Partial Equilibrium Analysis. *American Journal of Agricultural Economics* 88(4): 799-815.

Ciaian, P. and J.F.M. Swinnen 2009. Credit market imperfections and the distribution of policy rents. *American Journal of Agricultural Economics* 91(4): 1124-1139

Ciaian, P., D. Kancs, and J.F.M. Swinnen. 2008. Static and Dynamic Distributional Effects of Decoupled Payments: Single Farm Payments in the European Union. LICOS Discussion Paper 207/2008, LICOS, Leuven.

Ciaian, P., D. Kancs, and J.F.M. Swinnen 2010. *EU Land Markets and the Common Agricultural Policy*. Brussels: CEPS.

Ciaian, P., Kancs, D. and Swinnen, J.F.M. 2014. The Impact of the 2013 Reform of the Common Agricultural Policy on Land Capitalization in the European Union. *Applied Economic Perspectives and Policy* 37(3): 1–31.

Cimino, O., R. Henke and F. Vanni 2015. The effects of CAP greening on specialised arable farms in Italy. *New Medit* 2: 22-31.

Courleux, F., H. Guyomard, F Levert, and L. Piet. 2008. How the EU Single Farm Payment should be Modelled: Lump-sum Transfers, Area Payments or… what else? Working Paper SMART – LERECO N°08-01. Rennes: INRA.

Desquilbet, M. and H. Guyomard. 2002. Taxes and Subsidies in Vertically Related Markets. *American Journal of Agricultural Economics* 84(4): 1033-1041.

de Gorter, H. 1992. Assessing the Transfer Efficiency of Agricultural Support Policies. Report to OECD, Paris: OECD.

de Gorter, H. and K.D. Meilke. 1989. Efficiency of Alternative Policies for the EC's Common Agricultural Policy. *American Journal of Agricultural Economics* 71: 592-603.

Dewbre, J., J. Anton, and W. Thompson. 2001. The Transfer Efficiency and Trade Effects of Direct Payments. *American Journal of Agricultural Economics* 83(5): 1204-14.

European Commission. 2007a. Agriculture in the European Union - Statistical and economic Information 2007. Directorate for Agriculture and Rural Development (DG AGRI), Bruxelles.

European Commission 2007b. Study to Assess the Administrative Burden on Farms Arising from the CAP. Final Report, Bruxelles: Directorate for Agriculture and Rural Development (DG AGRI).

European Commission 2011a. Proposal for a regulation of the European Parliament and of the council establishing rules for Direct Payments to Farmers under Support Schemes within the Framework of the Common Agricultural Policy. COM(2011) 625, European Commission, Brussels, 19 October 2011.

European Commission 2011b. *Impact Assessment: Common Agricultural Policy towards 2020*. Brussels: European Commission.

European Commission 2011c. Factsheet: The Single Payment Scheme. European Commission, Directorate for Agriculture and Rural Development (DG AGRI), Bruxelles.

European Commission 2013a. EU agriculture - Statistical and economic information - 2013. European Commission, Directorate for Agriculture and Rural Development (DG AGRI), Bruxelles.

European Commission 2013b. Overview of CAP reform 2014-2020. Agricultural Policy Perspectives Brief No. 5/December 2013. European Commission, Directorate General for Agriculture and Rural Development, <http://ec.europa.eu/agriculture/policy-perspectives/policy-briefs/05_en.pdf>

European Commission 2015. Direct Payments: the Basic Payment Scheme from 2015 - Convergence of the value of payment entitlements ('Internal Convergence'). European Commission, Directorate for Agriculture and Rural Development (DG AGRI), Bruxelles.

European Commission 2015b. Direct Support-Horizontal. "SPS application accepted at MS level-Claim year 2013".

European Commission 2015c. Direct payments post 2014 Decisions taken by Member States by 1 August 2014 - State of play on 07.05.2015-, European Commission, DG Agriculture

and Rural Development. http://ec.europa.eu/agriculture/direct-support/direct payments/docs/implementation-decisions-ms_en.pdf
European Commission 2014. 7th financial Report from the European Commission to the European Parliament and the Council on the European Guarantee Fund. Financial year 2013.COM(2014). 561 FINAL.
European Commission 2016. Direct Payments: Basic Payment Scheme. European Commission, Directorate for Agriculture and Rural Development (DG AGRI), Bruxelles.
EU. 2013. Regulation No 1307/2013 of European Parliament and the Council Establishing Rules for Direct Payments to Farmers under Support Schemes within the Framework of the Common Agricultural Policy and Repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009. *Official Journal of the European Union* L 347/608.
Feichtinger, P. and K. Salhofer. 2013. The Impact of the CAP on Land Rents and Land Allocation. In *Land, Labour and Capital Markets in European Agriculture: Diversity Under A Common Policy*, eds. J. Swinnen, and L. Knops, 72-80. Brussels: Centre for European Policy Studies.
Feichtinger, P. and Salhofer, K. 2015a. Single Farm Payments of the CAP and Land Rental Prices. Discussion Paper, Department of Agricultural Economics and Economics, Montana State University.
Feichtinger, P. and Salhofer, K. 2015b. The Fischler Reform of the Common Agricultural Policy and Agricultural Land Prices. Discussion Paper No. DP-58-2015, Institut für nachhaltige Wirtschaftsentwicklung, Universität für Bodenkultur Wien.
Gardner, B. 1983. Efficient Redistribution through Commodity Markets. *American Journal of Agricultural Economics* 65(2): 225-234.
Gocht, A., W. Britz, P. Ciaian, and S. Gomez y Paloma. 2013. Farm Type Effects of an EU-wide Direct Payment Harmonisation. *Journal of Agricultural Economics* 64(1): 1-32.
Gocht, A., Roder, N. and Ciaian, P. 2015. Modelling CAP 'greening' in CAPRI. 2015 Paper presented at the conference of the International Association of Agricultural Economists, August 9-14, 2015, Milan, Italy.
Guastella, G., D. Moro, P. Sckokai, and M. Veneziani. 2013. The Capitalization of Area Payment into Land Rental Prices: Evidence from Italy. Paper presented at the International Agricultural Trade Research Consortium (IATRC) Symposium: Productivity and Its Impacts on Global Trade, June 2-4, 2013, Seville, Spain.
Guastella, G., Moro, D. Sckokai, P. and Veneziani, M. 2014. The Capitalization of Area Payment into Land Rental Prices: A Panel Sample Selection Approach. Paper presented at the EAAE Congress: 'Agri-food and Rural Innovations for Healthier Societies', 26-29 August 2014, Ljubljana, Slovenia.
Guyomard, H., C. Le Mouël, and A. Gohin. 2004. Impacts of Alternative Agricultural Income Support Schemes on Multiple Policy Goals. *European Review of Agricultural Economics* 31(2): 125-148.
Johansson, S. and P. Nilsson. 2012. Location Determinants of Agricultural Land Prices. *Jahrbuch für Regionalwissenschaft* 33: 1–21.
Karlsson, J. and Nilsson, P. 2014. Capitalisation of Single Farm Payment on farm price: an analysis of Swedish farm prices using farm-level data. *European Review of Agricultural Economics* 41(2): 279–300.
Kilian, S. and K. Salhofer. 2008. Single Payments of the CAP: Where Do the Rents Go? *Agricultural Economics Review* 9(2): 96-106.
Kilian, S., J. Antón, K. Salhofer, and N. Röder. 2012. Impacts of 2003 CAP Reform on Land Rental Prices and Capitalization. *Land use policy* 29(4): 789-797.

Kirwan, B. 2009. The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates. *Journal of Political Economy* 117(1): 138-164.

Klaiber, H.A., K. Salhofer and S. Thompson. 2016. "Capitalization of the SPS into Agricultural Land Rental Prices under Harmonization of Payments,""Working Paper No. 622016, Institute for Sustainable Economic Development, Department of Economics and Social Sciences, University of Natural Resources and Life Sciences, Vienna.

Louhichi, L., P. Ciaian, M. Espinosa, L. Colen, A. Perni and S. Gomez y Paloma. 2015. Individual Farm Model for Common Agricultural Policy Analysis (IFM-CAP). JRC-IPTS Working Papers JRC92574, Institute for Prospective and Technological Studies, Joint Research Centre, European Commission.

McCorriston, S. and I.M. Sheldon. 1991. Government Intervention in Imperfectly Competitive Agricultural Input Markets. *American Journal of Agricultural Economics* 73: 621-632.

Michalek, J., P. Ciaian, and D. Kancs. 2014. Capitalization of the Single Payment Scheme into Land Value: Generalized Propensity Score Evidence from EU. *Land Economics* 90(2): 260-289.

Mundlak, Y., R. Butzer and D.F. Larson 2012. Heterogeneous technology and panel data: The case of the agricultural production function. *Journal of Development Economics* 99(1): 139–149.

Nilsson, P. and Johansson, S. 2013. Location Determinants of Agricultural Land Prices. *Review of Regional Research* 33: 1–21.

O'Neill, S. and Hanrahan, K. 2016. The capitalization of coupled and decoupled CAP payments into land rental rates. *Agricultural Economics* 47: 1–10.

Patton, M., P. Kostov, S.A. McErlean, and J. Moss. 2008. Assessing the Influence of Direct Payments on the Rental Value of Agricultural Land. *Food Policy* 33(5): 397-405.

Petrick, M. and Kloss, M. 2013. Identifying Factor Productivity from Micro-data: The case of EU agriculture. Factor Markets WP 34, Centre for European Policy Studies (CEPS), Brussels.

Salhofer, K. 2001. Elasticities of Substitution and Factor Supply Elasticities in European Agriculture: A Review of Past Studies. In OECD Market Effects of Crop Support Measures, 89-119, Paris: OECD.

Salhofer, K. and E. Schmid. 2004. Distributive Leakages of Agricultural Support: Some Empirical Evidence. *Agricultural Economics* 30(1): 51-63.

Sckokai, P. and D. Moro. 2006. Modeling the Reforms of the Common Agricultural Policy for Arable Crops under Uncertainty. *American Journal of Agricultural Economics* 88(1): 43–56.

Sheldon, I.M., D.H. Pick, and S. McCorriston. 2001. Export Subsidies and Profit-Shifting in Vertical Markets. *Journal of Agricultural and Resource Economics* 26(1):125-141.

Solazzo, R., Donati, M., Arfini, F., Petriccione, G., 2014. A PMP model for the impact assessment of the Common Agricultural Policy reform 2014-2020 on the Italian tomato sector. New Medit. 2, 9-19.

Solazzo, R. and Pierangeli F. 2015. "A two-step modelling approach for the impact assessment of greening in Italy." Paper presentated at the 147th EAAE Seminar 'CAP Impact on Economic Growth and Sustainability of Agriculture and Rural Areas', Sofia, Bulgaria, October 7-8, 2015.

Van Herck, K., J. Swinnen, and L. Vranken. 2013. Capitalization of Direct Payments in Land Rents: Evidence from New EU Member States. *Eurasian Geography and Economics* 54(4): 423-443.

Was, A., Majewski, E., Czekaj, S. 2014. Impacts of CAP 'Greening' on Polish Farms. Paper presented at the EAAE 2014 Congress '*Agri-Food and Rural Innovations for Healthier Societies*' 26 - 29August, 2014 Ljubljana, Slovenia.

Viaggi, D., F. Bartolini, M. Puddu, and M. Raggi. 2013. The Impact of the 2013 CAP Reform on Land Markets in Italy. In *Land, Labour and Capital Markets in European Agriculture: Diversity Under A Common Policy*, eds. J. Swinnen, and L. Knops, 72-80. Brussels: Centre for European Policy Studies.

Figure 1. Development in land prices in EU (EUR/ha)

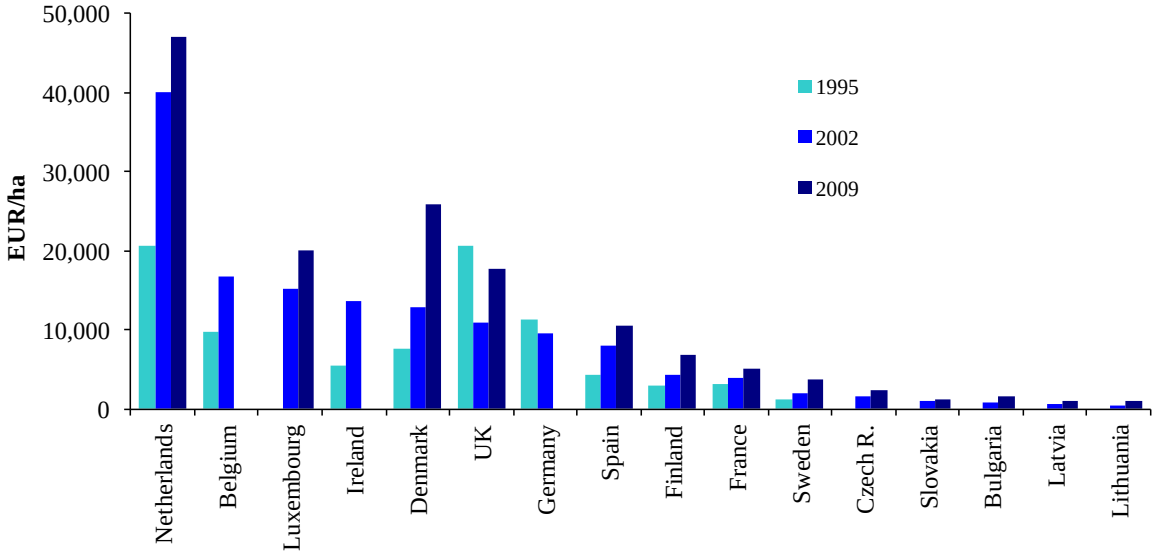


Figure 2. The effect of the SPS harmonization between MS

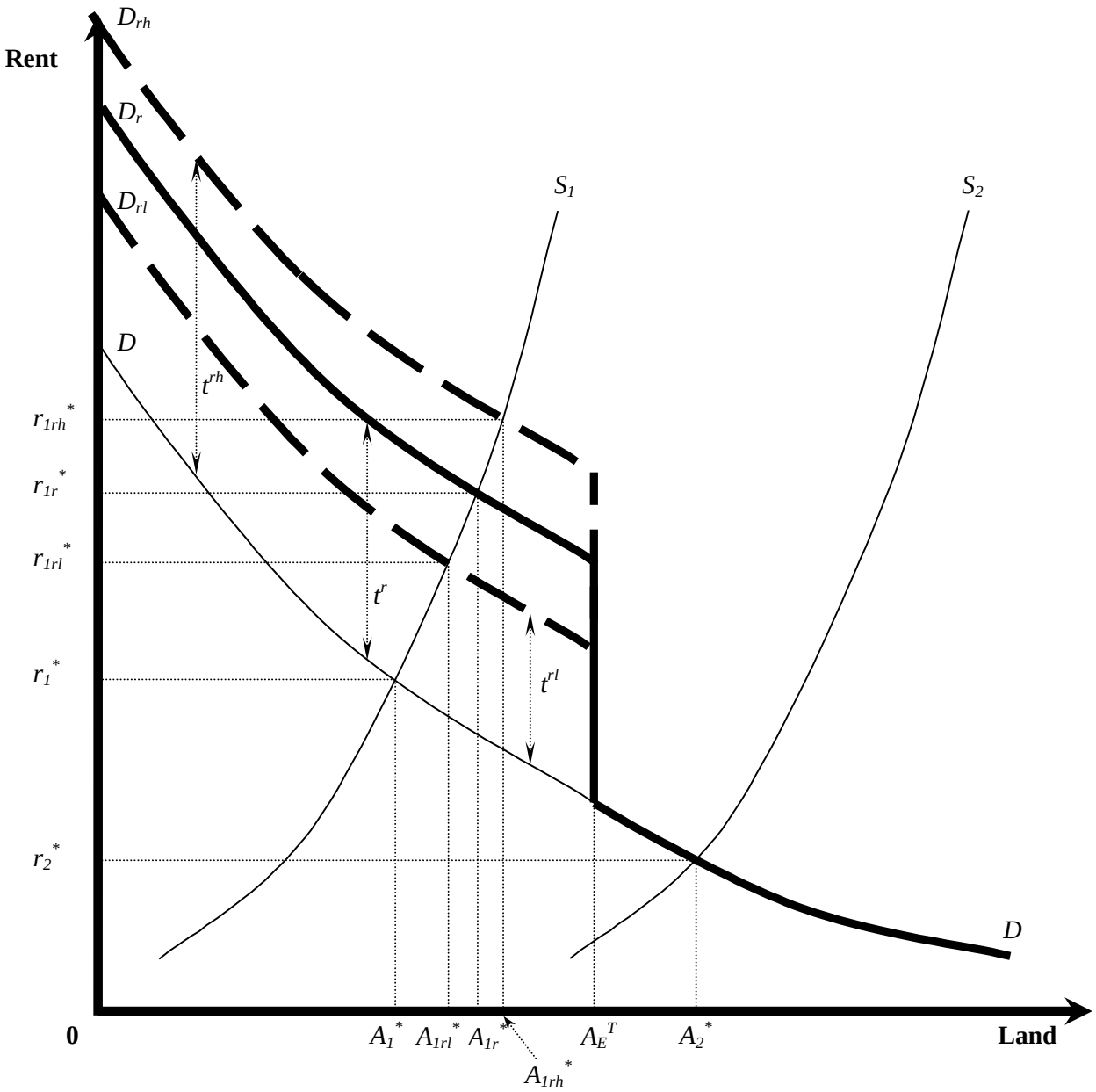
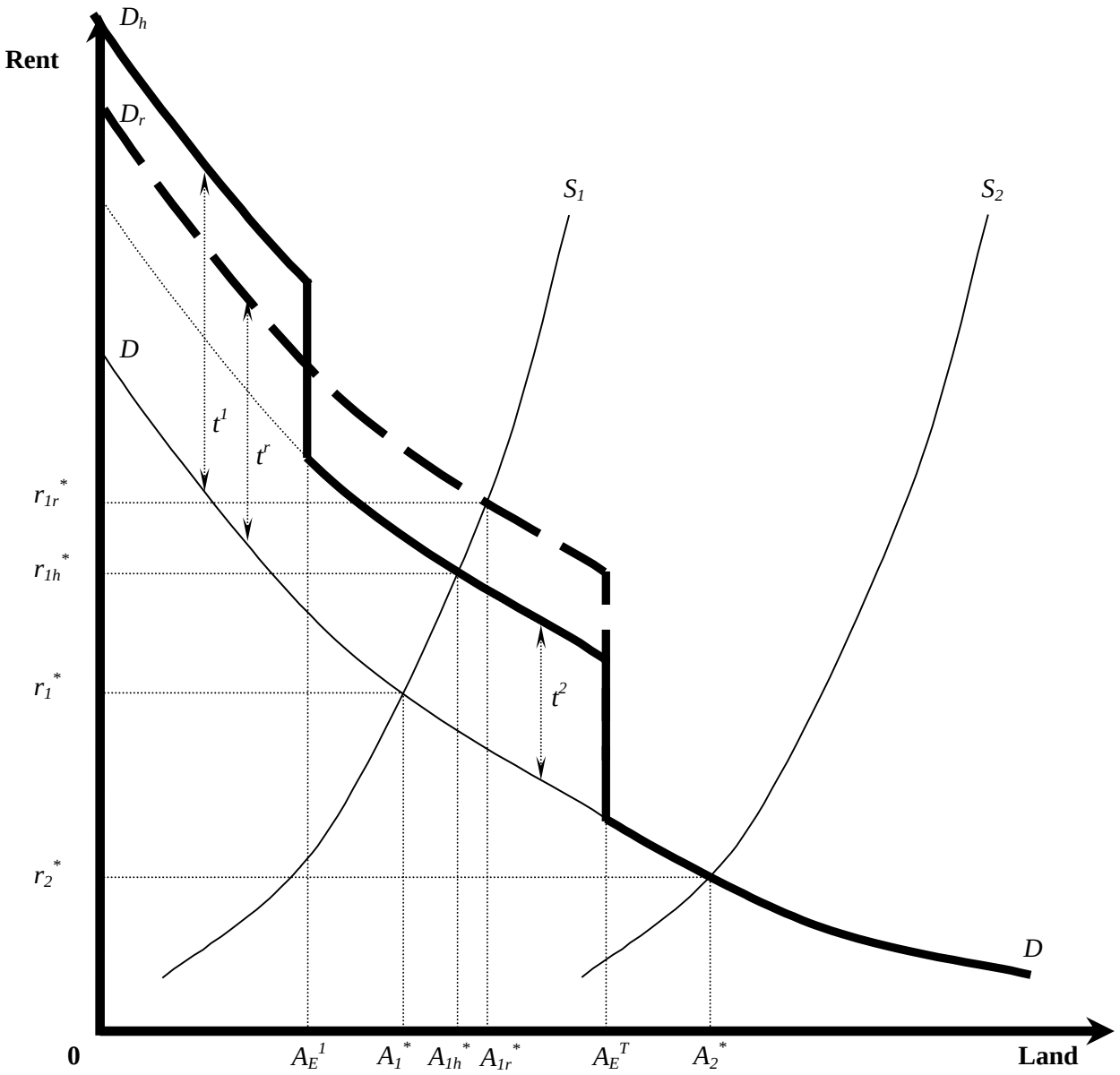


Figure 3. The effect of the SPS with surplus and deficit entitlements



0

Figure 4. The effect of the reference period

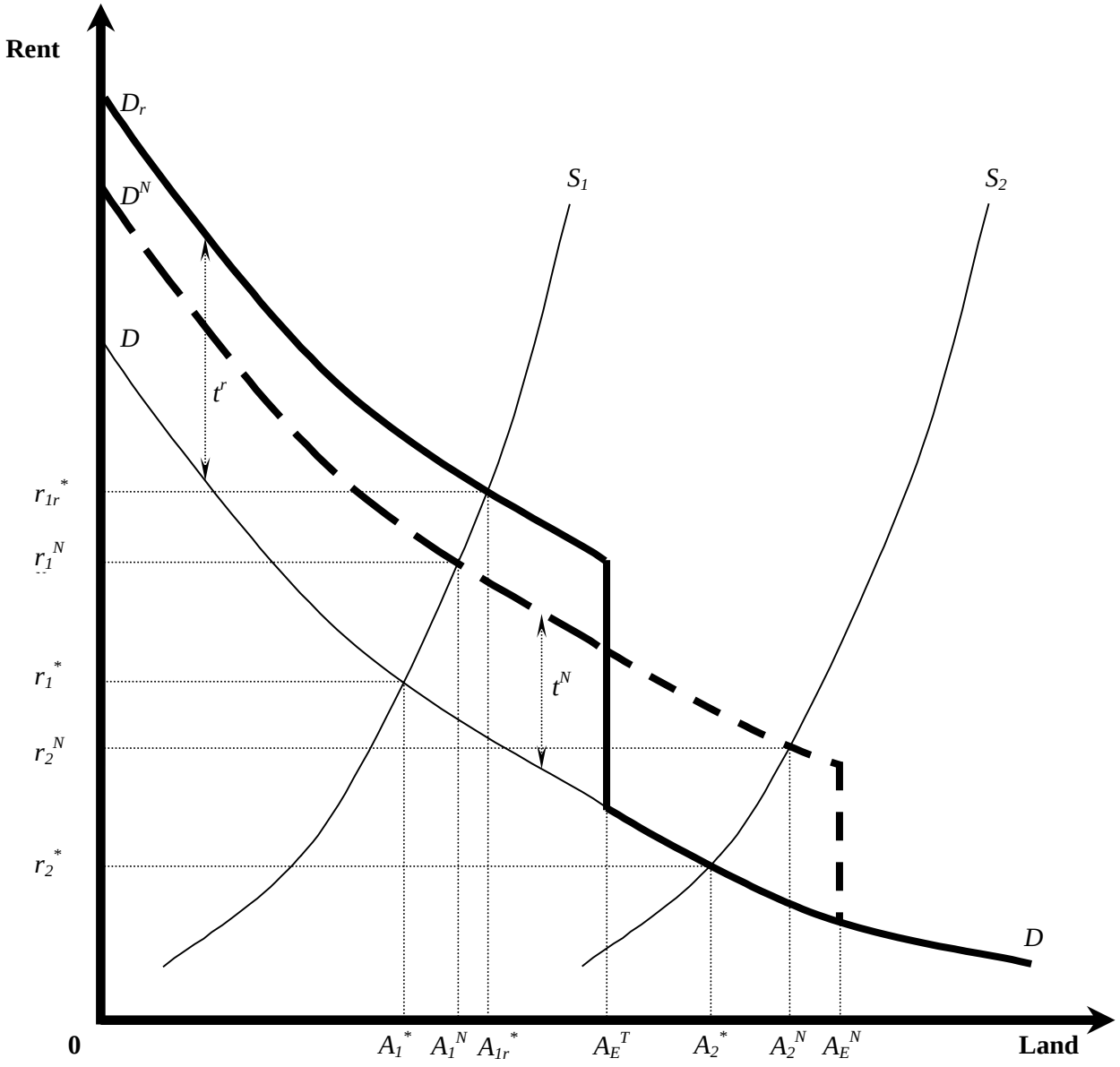


Figure 5. The effect of CAP 'greening'

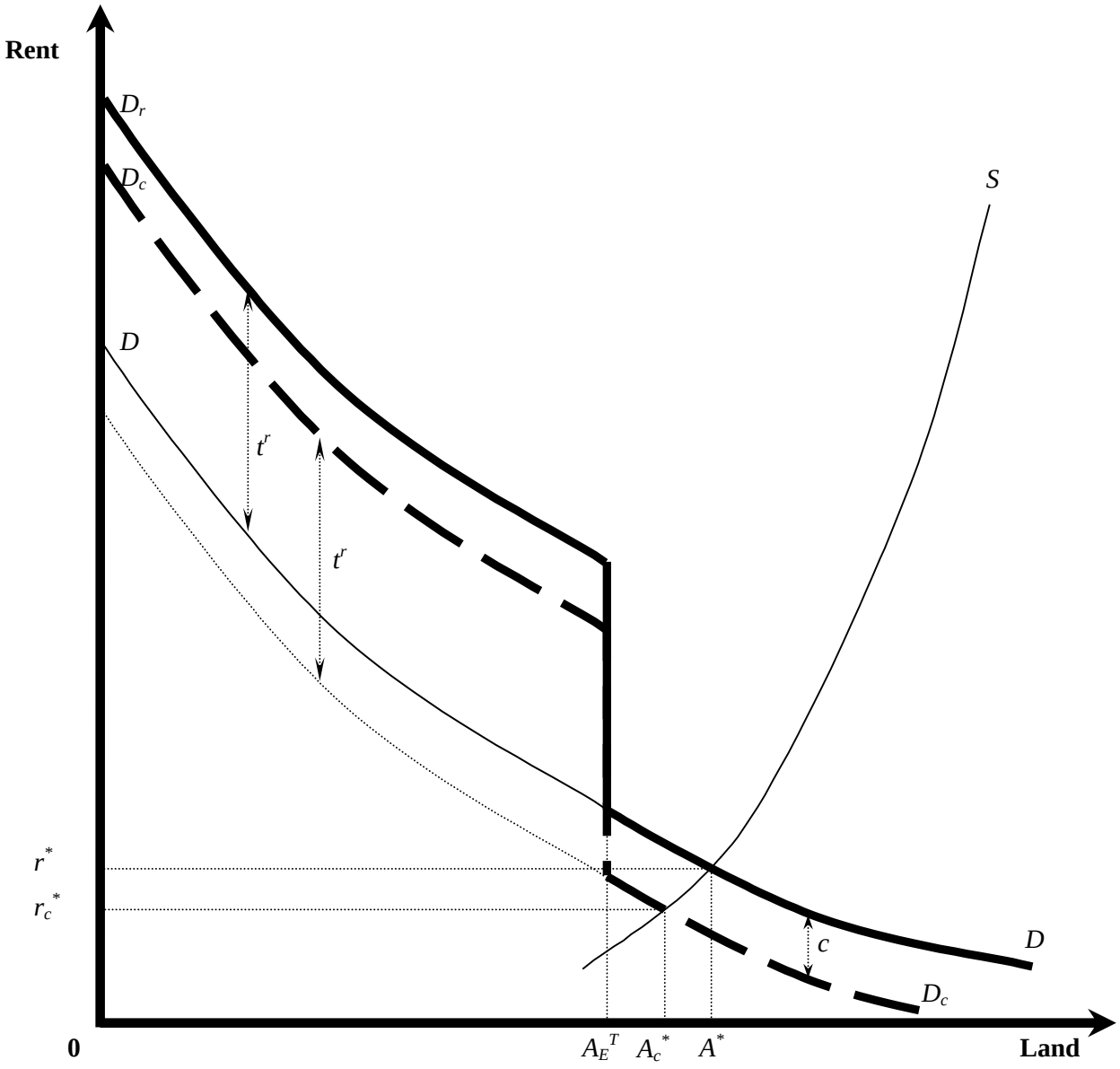


Figure 6. Estimated decoupled payments capitalization rates in NMS, OMS and EU

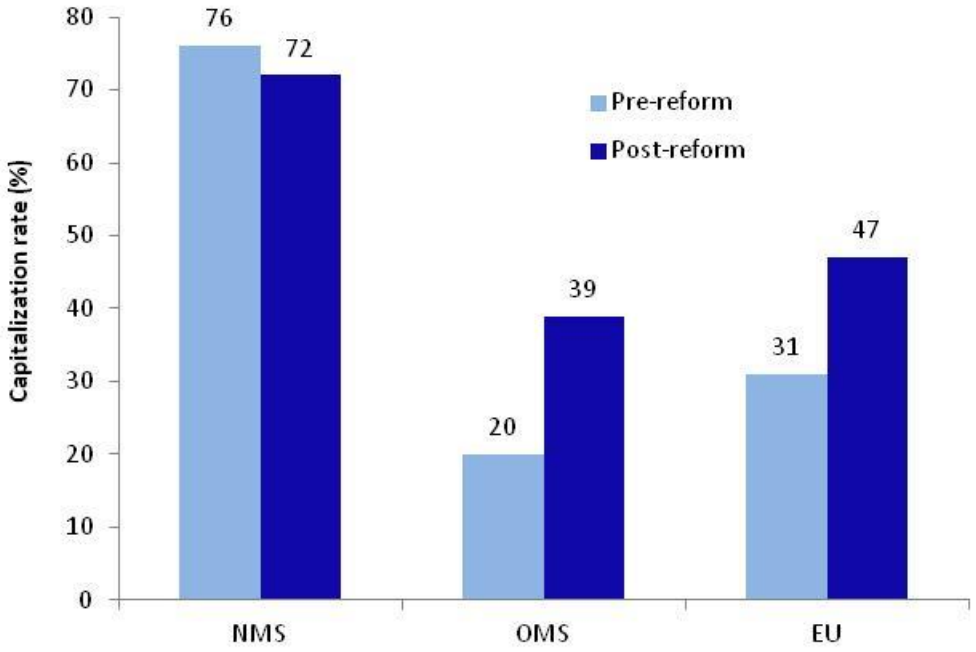


Figure 7. Sources of the 2013 CAP reform capitalization in NMS, OMS and EU

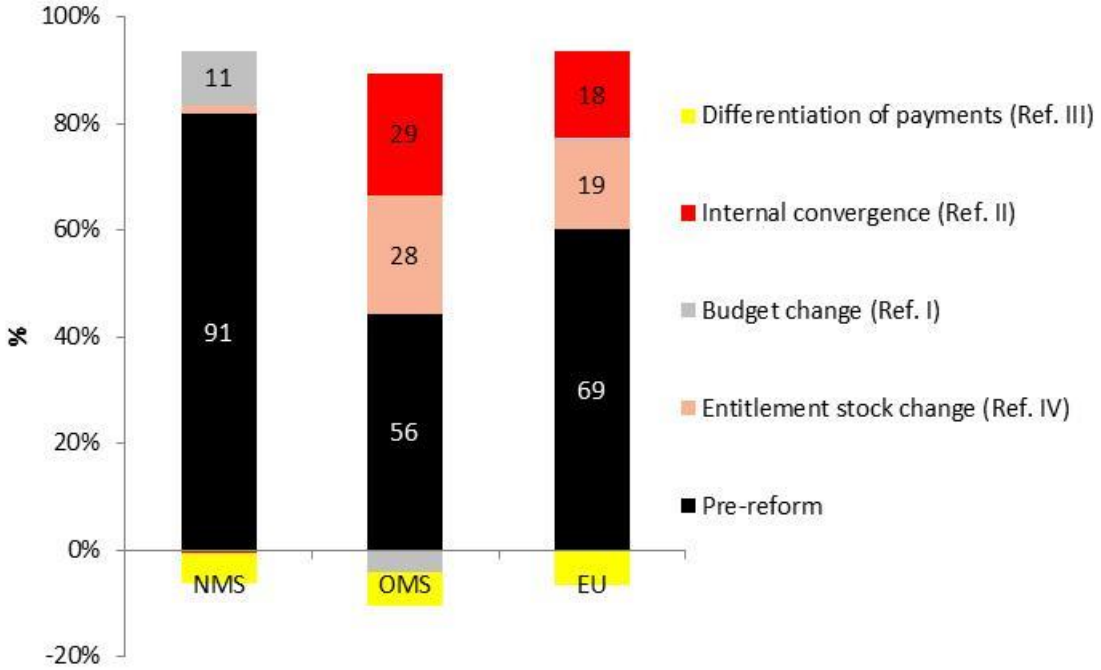


Figure 8. Non-farming land owners' gains from the decoupled payments in NMS, OMS and EU

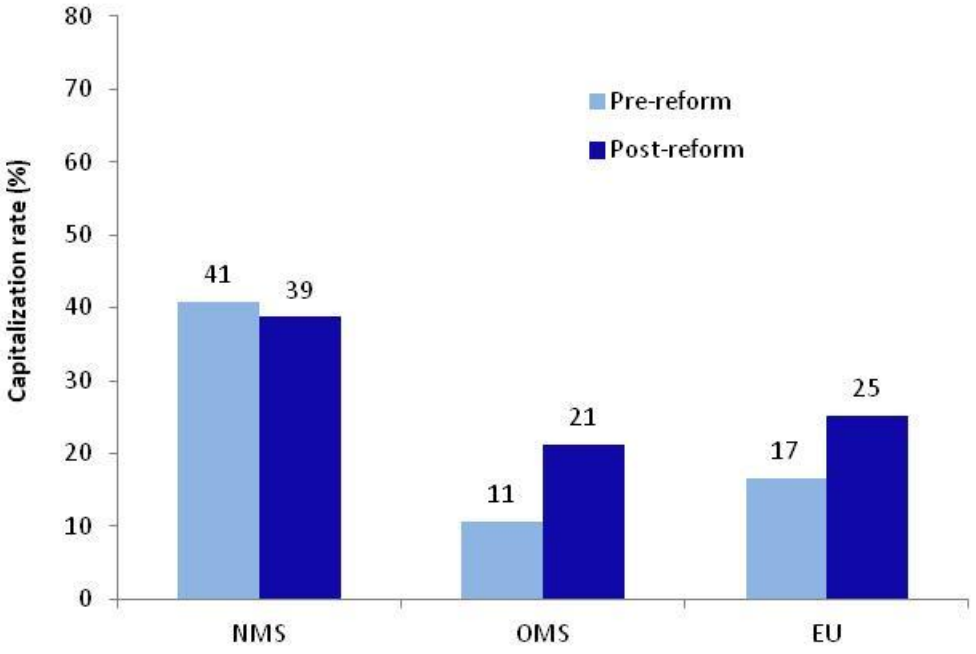


Table 1. Agricultural land sales as a percentage of the total utilized agricultural area

	Old member states	
	1998	**2006**
Belgium	1.63	1.28*
Finland	1.79	2.72
France	1.03	0.99*
Germany	0.58	0.58
Greece	0.41	0.35*
Ireland	3.04	2.90
Italy	1.60	1.42*
Netherlands	3.72	3.08
Spain	0.52	0.62
Sweden	0.63	0.62
UK	3.60	1.64*
	New member states	
	1998–2001**	**2005–2006****
Bulgaria	0.34	1.61
Czech Republic	2.8	3.30*
Estonia	n.a.	n.a.
Hungary	n.a.	3.6
Latvia	n.a.	n.a.
Lithuania	1.9	8.4
Poland	1.71	1.77
Romania	0.2	0.43
Slovakia	0.1	0.14

* Data from 2004

**Bulgaria: data for 1999 and 2006; Czech Republic: data for 1998 and 2005; Estonia: data for 2005, transacted arable land as a percentage of UAA; Hungary: data for 2006; Lithuania: number of sales and gifts, data for 2000 and 2006; Poland: data for 1998 and 2005; Romania: data for 1999 and 2005; Slovakia: data for 2001 and 2005

Sources: Ciaian et al. (2010); Swinnen and Vranken (2009; 2010).

Table 2. Land renting in the European Union

	2000	2004	2013	Change 2013/2000	Change 2013/2004
		% of UAA		*% change*	
Old Member States					
Belgium	75	75	73	-2.0	-2.1
Denmark	25	29	30	18.8	2.8
Germany	70	70	66	-5.6	-6.3
Greece	36	42	52	44.4	24.4
Spain	32	31	37	16.3	17.3
France	81	84	88	8.7	4.0
Ireland	18	19	19	3.7	1.6
Italy	36	36	47	29.8	28.7
Luxembourg	48	49	52	9.4	6.1
Netherlands	39	41	40	2.6	-2.5
Austria	26	30	28	5.0	-6.5
Portugal	28	36	27	-2.0	-24.1
Finland	32	34	35	7.9	1.6
Sweden	40	48	54	35.2	11.0
UK	39	40	43	8.2	5.6
New Member States					
Bulgaria	n.a	n.a	87	n.a	n.a
Cyprus	n.a	68	67	n.a	-0.7
Croatia	n.a	n.a	45	n.a	n.a
Czech R.	n.a	91	81	n.a	-10.8
Estonia	n.a	61	61	n.a	0.1
Hungary	n.a	66	62	n.a	-5.2
Latvia	n.a	39	47	n.a	20.3
Lithuania	n.a	52	51	n.a	-0.8
Malta	n.a	84	83	n.a	-1.1
Poland	n.a	27	27	n.a	0.8
Romania	n.a	n.a	55	n.a	n.a
Slovakia	n.a	97	94	n.a	-2.1
Slovenia	n.a	29	33	n.a	14.8
EU	50	52	54	3.9	4.2

Source: FADN (Farm Accountancy Data Network)
Note: FADN is representative of the EU commercial agricultural holdings in term of number of holdings, but not in terms of area.

Table 3. Rental prices in the European Union (EUR/ha)

	2000	2004	2013	Change 2013/2000	Change 2013/2004
		EUR/ha		*% change*	
Old Member States					
Belgium	190	233	286	50.8	22.9
Denmark	349	447	644	84.2	44.0
Germany	206	216	265	28.9	22.9
Greece	290	293	204	-29.6	-30.2
Spain	92	109	118	29.0	8.1
France	153	155	176	14.8	13.7
Ireland	286	258	247	-13.6	-4.1
Italy	167	199	189	12.9	-4.8
Luxembourg	191	197	219	14.5	10.7
Netherlands	706	776	974	37.8	25.5
Austria	189	193	236	24.7	22.4
Portugal	63	54	96	52.1	78.3
Finland	149	169	216	44.6	27.7
Sweden	166	141	219	32.0	55.2
UK	179	163	139	-22.1	-14.7
New Member States					
Bulgaria			178	n.a	n.a
Cyprus		164	178	n.a	8.4
Czech R.		27	78	n.a	183.6
Croatia	n.a	n.a	73	n.a	n.a
Estonia		5	30	n.a	446.7
Hungary		54	122	n.a	126.1
Lithuania		15	43	n.a	191.1
Latvia		11	25	n.a	140.1
Malta		106	112	n.a	5.6
Poland		36	71	n.a	95.8
Romania			91	n.a	n.a
Slovakia		24	47	n.a	96.7
Slovenia		38	103	n.a	172.5

Source: FADN

Table 4. SPS activated area in 2013

	SPS activated area (1000 ha)	Ratio to eligible area (%)
Old Member States		
Austria	2246	0.86
Belgium	1136	0.81
Germany	16533	0.99
Denmark	2591	0.99
Greece	3041	0.77
Spain	17050	0.74
Finland	2277	1.00
France	25969	0.97
Ireland	4198	0.89
Italy	7337	0.74
Luxembourg	118	0.95
Netherlands	1353	0.77
Portugal	2288	0.81
Sweden	2936	0.99
UK*	14838	0.95
New Member States		
Malta	7	0.95
Slovenia	413	0.93

Source: SPS activated area (European Commission,2015b) ; Eligible area used to calculate the ratio of activated area to eligible area: Statel/Edamis CATS and FSS data for 2013. If data were not available for a given year, the value from previous year was used or the average value of the previous and subsequent year. Notes: the table reports only the number of activated entitlements, which is different from the total allocated entitlements. Farmers may also hold additional entitlements, which they may not be able to use due to the unavailability of eligible land. The data on the amount of these unused entitlements are not available.

Table 5. Empirical evidence of decoupled payment capitalization into land values

Study	Type of area CAP subsidy (Country)	Percentage change in land sales price per 1 percent increase in subsidies	Share of subsidy capitalized into land rents (%)
Michalek, Ciaian and Kancs (2014)	SPS (EU, OMS)		6-10
Kilian *et al.* (2012)	SPS, hybrid (Germany, Bavaria)		44-94
Feichtinger and Salhofer (2015a)	SPS, hybrid (Germany, Bavaria)		35
Klaiber, Salhofer and Thompson (2016)	SPS, hybrid (Germany, Bavaria)		0.37-0.57
Guastella et al. (2014)	SPS, historical (Italy)		0
O'Neill and Hanrahan (2016)	SPS, historical (Ireland)		Short-run: 7-25 Long-run: 21-53
Ciaian and Kancs (2012)	SAPS (EU, NMS)		19
Van Herck, Swinnen and Vranken (2013)	SAPS (EU, NMS)		15-32
Nilsson and Johansson (2013)	SPS, hybrid (Sweden)	0.54	
Karlsson and Nilsson (2014)	SPS, hybrid (Sweden)	0.00	
Feichtinger and Salhofer (2015b)	SPS, hybrid (Germany, Bavaria)	0.20-0.28	

Table 6. The CAP budget before and after the reform (million Euros and Index)

	Decoupled payments			Total direct payments		
	2013	2019	Index 2019/2013	2013	2019	Index 2019/2013
Old Member States						
Austria	618	663	1.07	752	692	0.92
Belgium	461	392	0.85	615	482	0.78
Germany	5101	4745	0.93	5853	4793	0.82
Denmark	883	778	0.88	1049	818	0.78
Greece	1990	1651	0.83	2217	2022	0.91
Spain	4405	4211	0.96	5319	4953	0.93
Finland	469	423	0.90	571	525	0.92
France	6765	6039	0.89	8521	7190	0.84
Ireland	1206	1188	0.99	1341	1211	0.90
Italy	3629	3260	0.90	4370	3702	0.85
Luxembourg	33	33	0.99	37	33	0.90
Netherlands	779	683	0.88	898	701	0.78
Portugal	425	470	1.11	606	599	0.99
Sweden	677	595	0.88	771	700	0.91
UK	3171	3180	1.00	3898	3201	0.82
New Member States						
Bulgaria	551	705	1.28	580	793	1.37
Cyprus	52	44	0.86	54	49	0.91
Croatia		262			316	
Czech R.	806	731	0.91	909	857	0.94
Estonia	98	139	1.42	101	144	1.42
Hungary	1115	1139	1.02	1319	1274	0.97
Lithuania	351	430	1.23	380	517	1.36
Latvia	136	239	1.76	147	280	1.91
Malta	5.3	2.2	0.42	5.1	5.2	1.02
Poland	2707	2898	1.07	3045	3430	1.13
Romania	1211	1591	1.31	1265	1903	1.51
Slovenia	132	113	0.86	144	134	0.93
Slovakia	340	391	1.15	388	449	1.16
EU-27	38115	36732	0.96	45153	41456	0.92
EU-28	38115	36994	0.97	45153	41772	0.93

Sources: Data for 2013 based on European Commission (2014) and data for 2019 based on European Commission (2015c)

Notes: decoupled payments include BPS (SAPS), greening, redistributive payment and ANC (only in Denmark).
Total direct payments include: decoupled payments, the young farmer scheme, the voluntary coupled support and the small farmer scheme.

Table 7. The implementation of decoupled payments by Member State

	Pre-reform implementation*	2013 CAP reform		
		Internal convergence	Redistributive payment (max ha per farm; % of the budget)	Method of entitlement allocation
Old Member States				
Austria	SPS historical	National FR by 2019		New entitlements
Belgium-Wallonia	SPS historical	PC	Yes (30 ha; 17%)	New entitlements
Belgium-Flanders	SPS historical	PC		New entitlements***
Germany	SPS dynamic hybrid	National FR in 2019	Yes (46 ha; 7%)	New entitlements
Denmark	SPS static hybrid	PC		Old entitlements
Greece	SPS historical	Regional PC		New entitlements
Spain	SPS historical	Regional PC		New entitlements***
Finland	SPS dynamic hybrid	Regional FR by 2019		Old entitlements
France	SPS historical	PC**	Yes (52 ha; 20%)	New entitlements
Ireland	SPS historical	PC		New entitlements***
Italy	SPS historical	PC		New entitlements
Luxembourg	SPS static hybrid	PC		New entitlements
Netherlands	SPS historical	National FR by 2019		New entitlements
Portugal	SPS historical	PC		New entitlements***
Sweden	SPS static hybrid	PC		Old entitlements
UK- England	SPS dynamic hybrid	Regional FR in 2015		Old entitlements
UK- Scotland	SPS historical	Regional FR by 2019		New entitlements
UK- Wales	SPS historical	National FR by 2019	Yes (54 ha; 3%)	New entitlements
UK- N. Ireland	SPS static hybrid	PC		
New Member States				
Bulgaria	SAPS	SAPS	Yes (30 ha; 7%)	
Cyprus	SAPS	SAPS		
Czech R.	SAPS	SAPS		
Croatia	-	PC	Yes (20 ha, 10%)	New entitlements
Estonia	SAPS	SAPS		
Hungary	SAPS	SAPS		
Lithuania	SAPS	SAPS	Yes (30 ha; 15%)	
Latvia	SAPS	SAPS		
Malta	SPS regional	National FR in 2015		New entitlements
Poland	SAPS	SAPS	Yes (30; 8%)	
Romania	SAPS	SAPS	Yes (30; 5%)	
Slovenia	SPS regional	PC		New entitlements
Slovakia	SAPS	SAPS		

Notes:
** Those MS implementing the dynamic hybrid model gradually move to a fully regional model. In MS implementing the static hybrid model, the regional and the historical shares do not change over time;*
*** Except for France-Corsica which applies flat-rate from 2015;*
**** MS limits the allocated entitlements to the minimum between the eligible area in 2013 and the declared eligible area in 2015*
FR: flat rate; PC: partial convergence by 2019;
Source: European Commission 2007a, 2013a, 2015, 2015c, 2016.

Table 8. Data used for the capitalization quantifications

	Entitlements (No. in 1000 and %)**				Eligible area (1000 ha)		Average payment (tav) (Euro per entitlement or per ha)		Marginal payment (tm) (Euro per entitlement or per ha)		Marginal payment value by reform element (Euro per entitlement or per ha)							
	2013	Ratio to eligible area (%)	2019	Ratio to eligible area (%)	2013	2019	2013	2019	2013	2019	Entitlement stock change (Ref. IV)		Budget change (Ref. I)		Internal convergence (Ref. II)		Differentiation of payments (Ref. III)	
											Value	Change	Value	Change	Value	Change	Value	Change
Old Member States																		
Austria	2246	0.86	2226	0.78	2601	2862	275.2	298.0	29.7	298.0	30.0	0.3	32.2	2.2	298.0	265.8	298.0	0.0
Belgium	1136	0.81	1406	1.00	1405	1405	405.7	278.7	122.1	112.5	98.6	-23.5	83.9	-14.7	127.5	43.6	112.5	-15.0
Germany	16533	0.99	16861	1.00	16764	16863	308.6	281.4	308.6	261.5	302.5	-6.0	281.4	-21.1	281.4	0.0	261.5	-19.9
Denmark	2591	0.99	2591	0.99	2608	2608	340.8	300.3	258.9	227.3	258.9	0.0	228.1	-30.8	227.3	-0.8	227.3	0.0
Greece	3041	0.77	5110	1.18	3924	4333	654.5	323.2	64.3	85.9	38.2	-26.0	31.7	-6.5	85.9	54.2	85.9	0.0
Spain	17050	0.74	21753	0.94	23181	23181	258.3	193.6	20.7	57.5	16.2	-4.5	15.5	-0.7	57.5	42.0	57.5	0.0
Finland	2277	1.00	2277	1.00	2288	2288	205.9	185.7	141.9	185.7	141.9	0.0	128.0	-13.9	185.7	57.7	185.7	0.0
France	25969	0.97	28480	1.01	26732	28184	260.5	212.1	50.8	79.7	46.3	-4.5	41.4	-5.0	104.6	63.2	79.7	-24.9
Ireland	4198	0.89	4986	1.06	4712	4712	287.3	238.3	38.2	98.0	32.1	-6.0	31.7	-0.5	98.0	66.3	98.0	0.0
Italy	7337	0.74	13132	1.00	9976	13134	494.7	248.2	66.9	85.8	37.4	-29.5	33.6	-3.8	85.8	52.3	85.8	0.0
Luxembourg	118	0.95	131	1.00	123	131	281.2	249.9	84.7	114.4	75.9	-8.7	75.2	-0.7	114.4	39.1	114.4	0.0
Netherlands	1353	0.77	1866	1.02	1750	1838	575.6	366.2	57.6	366.2	41.7	-15.8	36.6	-5.1	366.2	329.5	366.2	0.0
Portugal	2288	0.81	2824	1.00	2824	2824	185.8	166.4	15.1	68.9	12.3	-2.9	13.6	1.3	68.9	55.3	68.9	0.0
Sweden	2936	0.99	2936	0.99	2966	2966	230.4	202.6	108.1	117.5	108.1	0.0	95.1	-13.1	117.5	22.4	117.5	0.0
UK*	14838	0.95	16622	0.99	15574	16752	213.7	191.3	213.7	186.4	190.8	-22.9	191.3	0.5	191.3	0.0	186.4	-4.9
New Member States																		
Bulgaria					3754	3754	146.8	187.7	146.8	172.8	146.8	0.0	187.7	40.9	187.7	0.0	172.8	-14.9
Cyprus					127	127	405.7	347.6	405.7	347.6	405.7	0.0	347.6	-58.1	347.6	0.0	347.6	0.0
Croatia			1302	1.00	900	1302	-	201.6	-	177.3	-	-	-	-	-	-	-	-
Czech R.					3528	3528	228.5	207.1	228.5	207.1	228.5	0.0	207.1	-21.4	207.1	0.0	207.1	0.0
Estonia					925	966	101.3	143.6	101.3	143.6	101.3	0.0	143.6	42.3	143.6	0.0	143.6	0.0
Hungary					5011	5340	208.8	213.3	208.8	213.3	208.8	0.0	213.3	4.5	213.3	0.0	213.3	0.0
Lithuania					2760	2891	121.5	148.9	121.5	122.1	121.5	0.0	148.9	27.4	148.9	0.0	122.1	-26.8
Latvia					1635	1868	72.6	127.8	72.6	127.8	72.6	0.0	127.8	55.2	127.8	0.0	127.8	0.0
Malta	7	0.95	12	1.01	8	12	712.8	189.1	712.8	189.1	448.5	-264.2	189.1	-259.4	189.1	0.0	189.1	0.0
Poland					14078	14410	187.8	201.1	187.8	181.3	187.8	0.0	201.1	13.3	201.1	0.0	181.3	-19.9
Romania					9942	9942	121.8	160.0	121.8	149.8	121.8	0.0	160.0	38.2	160.0	0.0	149.8	-10.2
Slovenia	413	0.93	479	1.00	444	479	319.3	235.5	319.3	132.6	275.1	-44.2	235.5	-39.6	132.6	-102.9	132.6	0.0
Slovakia					1883	1883	180.3	207.4	180.3	207.4	180.3	0.0	207.4	27.1	207.4	0.0	207.4	0.0

Source: Number of entitlements: European Commission (2015b); Eligible area in 2013: CATS-database data (DG-AGRI) and FSS; Eligible area in 2019: calculated based on CATS-database data (DG-AGRI) and FSS and eligible area in 2013 (by adding to 2013 eligible area the new eligible crops and deducting the crops not eligible in the relevant MS (e.g. greenhouses, vineyards); Number of entitlements for 2013: Table 4; Number of entitlements for 2019: calculated based on FADN data. Average payment value: calculated by dividing the total decoupled envelope from Table 6 by the number of entitlements for SPS or by the total eligible area for SAPS; Marginal payment values: see the data section in the paper.

Table 9. Expected impact of the 2013 CAP reform on decoupled payments capitalization

	Pre-reform capitalization rate (% of 1 Euro of DP)			2013 CAP reform capitalization rate (% of 1 Euro of DP)		
	Central	Low	High	Central	Low	High
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Old Member States						
Austria	0.00	0.00	0.00	0.00	0.00	0.00
Belgium	0.00	0.00	0.00	0.31	0.27	0.37
Germany	0.78	0.00	0.90	0.72	0.62	0.84
Denmark	0.59	0.51	0.69	0.59	0.50	0.68
Greece	0.00	0.00	0.00	0.21	0.18	0.24
Spain	0.00	0.00	0.00	0.00	0.00	0.00
Finland	0.54	0.46	0.62	0.78	0.67	0.90
France	0.15	0.00	0.18	0.29	0.25	0.34
Ireland	0.00	0.00	0.00	0.32	0.27	0.37
Italy	0.00	0.00	0.00	0.27	0.23	0.31
Luxembourg	0.00	0.00	0.27	0.36	0.31	0.41
Netherlands	0.00	0.00	0.00	0.78	0.67	0.90
Portugal	0.00	0.00	0.00	0.32	0.28	0.37
Sweden	0.36	0.31	0.42	0.45	0.39	0.52
UK*	0.00	0.00	0.90	0.76	0.65	0.88
New Member States						
Bulgaria	0.78	0.67	0.90	0.72	0.61	0.83
Cyprus	0.78	0.67	0.90	0.78	0.67	0.90
Croatia	-	-	-	0.68	0.59	0.80
Czech R.	0.78	0.67	0.90	0.78	0.67	0.90
Estonia	0.78	0.67	0.90	0.78	0.67	0.90
Hungary	0.78	0.67	0.90	0.78	0.67	0.90
Lithuania	0.78	0.67	0.90	0.64	0.55	0.74
Latvia	0.78	0.67	0.90	0.78	0.67	0.90
Malta	0.00	0.00	0.00	0.78	0.67	0.90
Poland	0.78	0.67	0.90	0.70	0.60	0.82
Romania	0.78	0.67	0.90	0.73	0.62	0.85
Slovenia	0.00	0.00	0.00	0.44	0.38	0.51
Slovakia	0.78	0.67	0.90	0.78	0.67	0.90
NMS	0.76	0.65	0.89	0.72	0.62	0.84
OMS	0.20	0.03	0.32	0.39	0.34	0.46
EU	0.31	0.15	0.43	0.47	0.40	0.55

*Notes: * The SPS model as in UK-England was assumed for UK; Aggregated values for NMS, OMS and EU are weighted averages over MS using decoupled payments as weights.*

Table 10. Sources of the 2013 CAP reform capitalization

	Pre-reform			Entitlement stock change (Ref. IV)			Budget change (Ref. I)			Internal convergence (Ref. II)			Differentiation of payments (Ref. III)		
	Central	Low	High	Central	Low	High	Central	Low	High	Central	Low	High	Central	Low	High
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Old Member States															
Austria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium	0.0	0.0	0.0	87.6	87.6	87.6	-13.1	-13.1	-13.1	38.8	38.8	38.8	-13.3	-13.3	-13.3
Germany	118.0	0.0	118.0	-2.3	115.7	-2.3	-8.1	-8.1	-8.1	0.0	0.0	0.0	-7.6	-7.6	-7.6
Denmark	113.9	113.9	113.9	0.0	0.0	0.0	-13.5	-13.5	-13.5	-0.4	-0.4	-0.4	0.0	0.0	0.0
Greece	0.0	0.0	0.0	44.5	44.5	44.5	-7.6	-7.6	-7.6	63.1	63.1	63.1	0.0	0.0	0.0
Spain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finland	76.4	76.4	76.4	0.0	0.0	0.0	-7.5	-7.5	-7.5	31.1	31.1	31.1	0.0	0.0	0.0
France	63.8	0.0	63.8	-5.6	58.2	-5.6	-6.2	-6.2	-6.2	79.3	79.3	79.3	-31.2	-31.2	-31.2
Ireland	0.0	0.0	0.0	32.8	32.8	32.8	-0.5	-0.5	-0.5	67.7	67.7	67.7	0.0	0.0	0.0
Italy	0.0	0.0	0.0	43.5	43.5	43.5	-4.4	-4.4	-4.4	60.9	60.9	60.9	0.0	0.0	0.0
Luxembourg	0.0	0.0	74.0	66.4	66.4	-7.6	-0.6	-0.6	-0.6	34.2	34.2	34.2	0.0	0.0	0.0
Netherlands	0.0	0.0	0.0	11.4	11.4	11.4	-1.4	-1.4	-1.4	90.0	90.0	90.0	0.0	0.0	0.0
Portugal	0.0	0.0	0.0	17.8	17.8	17.8	1.9	1.9	1.9	80.3	80.3	80.3	0.0	0.0	0.0
Sweden	92.0	92.0	92.0	0.0	0.0	0.0	-11.1	-11.1	-11.1	19.1	19.1	19.1	0.0	0.0	0.0
UK*	0.0	0.0	114.6	102.3	102.3	-12.3	0.3	0.3	0.3	0.0	0.0	0.0	-2.6	-2.6	-2.6
New Member States															
Bulgaria	85.0	85.0	85.0	0.0	0.0	0.0	23.6	23.6	23.6	0.0	0.0	0.0	-8.6	-8.6	-8.6
Cyprus	116.7	116.7	116.7	0.0	0.0	0.0	-16.7	-16.7	-16.7	0.0	0.0	0.0	0.0	0.0	0.0
Croatia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Czech R.	110.3	110.3	110.3	0.0	0.0	0.0	-10.3	-10.3	-10.3	0.0	0.0	0.0	0.0	0.0	0.0
Estonia	70.5	70.5	70.5	0.0	0.0	0.0	29.5	29.5	29.5	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	97.9	97.9	97.9	0.0	0.0	0.0	2.1	2.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Lithuania	99.5	99.5	99.5	0.0	0.0	0.0	22.4	22.4	22.4	0.0	0.0	0.0	-22.0	-22.0	-22.0
Latvia	56.8	56.8	56.8	0.0	0.0	0.0	43.2	43.2	43.2	0.0	0.0	0.0	0.0	0.0	0.0
Malta	0.0	0.0	0.0	237.1	237.1	237.1	-137.1	-137.1	-137.1	0.0	0.0	0.0	0.0	0.0	0.0
Poland	103.6	103.6	103.6	0.0	0.0	0.0	7.3	7.3	7.3	0.0	0.0	0.0	-11.0	-11.0	-11.0
Romania	81.3	81.3	81.3	0.0	0.0	0.0	25.5	25.5	25.5	0.0	0.0	0.0	-6.8	-6.8	-6.8
Slovenia	0.0	0.0	0.0	207.5	207.5	207.5	-29.8	-29.8	-29.8	-77.6	-77.6	-77.6	0.0	0.0	0.0
Slovakia	86.9	86.9	86.9	0.0	0.0	0.0	13.1	13.1	13.1	0.0	0.0	0.0	0.0	0.0	0.0
NMS	91.2	91.2	91.2	1.7	1.7	1.7	11.4	11.4	11.4	-0.6	-0.6	-0.6	-6.5	-6.5	-6.5
OMS	55.9	9.2	80.9	28.4	75.1	3.4	-5.3	-5.3	-5.3	29.0	29.0	29.0	-8.1	-8.1	-8.1
EU	68.7	38.9	84.6	18.8	48.6	2.8	0.7	0.7	0.7	18.3	18.3	18.3	-7.5	-7.5	-7.5

Notes: * *The SPS model as in UK-England was assumed for UK; Aggregated values for NMS, OMS and EU are weighted averages over MS using decoupled payments as weights.*

Table 11. Land renting, and non-farming land owners' gains from the decoupled payments

	Share of rented farmland (2013)	Non-farming land owner gains (% of 1 Euro of DP)					
		Pre-reform capitalization rate			2013 CAP reform capitalization rate		
	(%)	Central	Low	High	Central	Low	High
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Old Member States							
Austria	27.6	0.0	0.0	0.0	0.0	0.0	0.0
Belgium	73.2	0.0	0.0	0.0	23.0	19.7	26.7
Germany	65.9	51.3	0.0	59.7	47.7	40.9	55.4
Denmark	29.9	17.6	15.1	20.5	17.6	15.1	20.4
Greece	52.2	0.0	0.0	0.0	10.8	9.3	12.6
Spain	36.8	0.0	0.0	0.0	0.0	0.0	0.0
Finland	34.6	18.5	15.9	21.6	26.9	23.1	31.3
France	87.8	13.3	0.0	15.5	25.7	22.0	29.9
Ireland	18.9	0.0	0.0	0.0	6.0	5.2	7.0
Italy	46.7	0.0	0.0	0.0	12.6	10.8	14.6
Luxembourg	52.2	0.0	0.0	14.2	18.6	15.9	21.6
Netherlands	40.0	0.0	0.0	0.0	31.1	26.7	36.2
Portugal	27.2	0.0	0.0	0.0	8.8	7.5	10.2
Sweden	53.7	19.6	16.8	22.8	24.2	20.8	28.2
UK*	42.7	0.0	0.0	38.6	32.4	27.7	37.6
New Member States							
Bulgaria	87.3	67.9	58.2	78.9	62.5	53.6	72.7
Cyprus	67.2	52.3	44.8	60.8	52.3	44.8	60.8
Croatia	45.0	-	-	-	30.8	26.4	35.8
Czech R.	80.9	62.9	53.9	73.2	62.9	53.9	73.2
Estonia	60.9	47.4	40.6	55.1	47.4	40.6	55.1
Hungary	62.2	48.3	41.4	56.2	48.3	41.4	56.2
Lithuania	51.5	40.0	34.3	46.6	32.8	28.1	38.2
Latvia	47.2	36.7	31.5	42.7	36.7	31.5	42.7
Malta	82.9	0.0	0.0	0.0	64.5	55.3	75.0
Poland	26.8	20.9	17.9	24.3	18.8	16.1	21.9
Romania	55.1	42.8	36.7	49.8	40.1	34.4	46.6
Slovenia	33.5	0.0	0.0	0.0	14.7	12.6	17.1
Slovakia	94.5	73.5	63.0	85.5	73.5	63.0	85.5
NMS	53.5	40.8	35.0	47.5	38.7	33.2	45.0
OMS	54.3	10.7	1.6	17.5	21.2	18.2	24.7
EU	53.8	16.6	8.2	23.3	25.2	21.6	29.3

Source: Own calculations based on the capitalization rates are constructed using estimates from Table 9 (columns 2 to 7) and land renting form FADN data for 2013.

*Notes: * The SPS model as in UK-England was assumed for UK; Aggregated values for NMS, OMS and EU are weighted averages over MS using decoupled payments as weights.*

Appendix 1: Derivation of the capitalization effects of decoupled payments

Following Ciaian, Kancs and Swinnen (2014) the market equilibrium without SPS can be defined as follows:

(3) $D(r) = S(r)$

The market equilibrium changes as follows for SAPS or for SPS if entitlements are in surplus:

(4) $D(r-t) = S(r)$ for SAPS or for SPS if $A^T \geq A^*$

Decoupled payments affect the market equilibrium if SPS entitlements, A_E^T, are in surplus (if $A^* \leq A_E^T$) or in the case of SAPS because all land is eligible for payments, $A_E^T = A$. This is shown for region 1 in Figure 2. However, if SPS entailments are in deficit than the decoupled subsidies do not affect the market equilibrium. This is shown for region 2 in Figure 2.
Totally differentiating the equilibrium conditions (4) yields:

(5) $\frac{\partial D}{\partial r}\Delta r - \frac{\partial D}{\partial r}\Delta t_m = \frac{\partial S}{\partial r}\Delta r$

where t_m is marginal value of decoupled payment. Converting the equation (5) in elasticity form yields:

(6) $\left(\frac{\partial S}{\partial r}\frac{r}{D} - \frac{\partial D}{\partial r}\frac{r}{D}\right)\Delta r = -\frac{\partial D}{\partial r}\frac{r}{D}\Delta t_m$

(7) $\frac{\Delta r}{\Delta t_m} = \frac{-\eta^D}{\eta^S - \eta^D} = K$ for SAPS or for SPS if $A^T \geq A^*$

where η^S and η^D are the land supply and land demand elasticities, respectively, with $\eta^S = (\Delta S/\Delta r)(r/S)$ and $\eta^D = (\Delta D/\Delta r)(r/D)$ and K is the capitalization parameter which determines how much one Euro of decoupled payments is capitalised in land rental prices, $K = -\eta^D/(\eta^S - \eta^D)$.

Equation (7) shows the marginal capitalization rate of the decoupled payments for SAPS and for SPS if entitlements are in surplus. The marginal capitalization rate decreases with land supply elasticity and increases with land demand elasticity. For example, in an extreme situation with fully inelastic land supply, $\eta^S = 0$, the marginal decoupled payments are fully capitalised in land rents, i.e. $\Delta r/\Delta t_m = 1$. Note that to derive the capitalization rate with equation (7) one needs to consider marginal value of decoupled payments if decoupled payments vary across farms. For example for the historical model shown in Figure 3, the marginal entitlement value is equal to t^2, $t_m = t^2$, whereas for the flat-rate SPS model shown in Figure 3, the marginal entitlement value is equal to the average payment value t^r, $t_m = t^r$. Similar to regional SPS model, for SAPS the marginal entitlement value is equal to the average payment value.

Reorganizing the equation (7) and dividing it by the average value of decoupled payment, t_{av}, one obtains the average capitalization rate

(8) $\frac{\Delta r}{t_{av}} = K\frac{\Delta t_m}{t_{av}}$

For the decoupled payment with homogenous payments between farms (e.g. SAPS or the flat-rate SPS model) $t_m = t_{av}$, while for payments where they differ between farms (e.g. historical SPS model) $t_m < t_{av}$.

Equations (8) indicates how much (% share) of one Euro of decoupled payments is reflected in higher rental prices. We use equations (8) to calculate the pre-reform capitalization rate which is defined as follows

$$(9)\quad \left.\frac{\Delta r}{t_{av}}\right|_O = K\frac{\Delta t_m}{t_{av}} \qquad \text{for SAPS or for SPS if } A^T \geq A^*$$

Next we derive the capitalization effect of the 2013 CAP reform. Assuming a given pre-reform decoupled subsidy system, and totally differentiating the equilibrium conditions (4) with respect to all reform elements yields:

$$(10)\quad \left.\frac{\Delta r}{t_{av}}\right|_N = K\left(\frac{\Delta t_m^I}{t_{av}} + \frac{\Delta t_m^{II}}{t_{av}} + \frac{\Delta t_m^{III}}{t_{av}} + \frac{\Delta t_m^{IV}}{t_{av}}\right) \qquad \text{for SAPS or for SPS if } A^T \geq A^*$$

where Δt_m^I, Δt_m^{II}, Δt_m^{III} and Δt_m^{IV} are changes in marginal value of decoupled payments due to the first, the second, the third and the fourth reform element, respectively. The equation (10) decomposes the contribution of the individual reform elements in the total change in the average capitalization rate.

Adding the pre-reform capitalization rate (9) to both sides of equation (10) and converting it to relive shares yields

$$(11)\quad 1 = sh^O + sh^I + sh^{II} + sh^{III} + sh^{IV}$$

where sh^i is the relative contribution (% share) of the reform element i to the total average capitalization rate of the 2013 CAP reform, for $i = I, II, III, IV$, with $sh^i = K\Delta t_m^I / t_{av} \Big/ \left.\Delta r / t_{av}\right|_N$, and sh^O is the relative contribution of the pre-reform capitalization to the total average capitalization rate of the 2013 CAP reform with $sh^O = \left.\Delta r / t_{av}\right|_O \Big/ \left.\Delta r / t_{av}\right|_N$. The sum over all five shares on the right hand side of equation (11) equals one (or 100%).

Equation (11) provides the contribution of each reform element alongside the pre-reform capitalization in the total average capitalization rate of the 2013 CAP reform. It gives information on the relative importance of the reform in affecting the capitalization of decoupled payments compared to the pre-reform capitalization rate.

Note that, the SPS capitalization rate for the case when entitlements are in deficit is zero: $\Delta r / \Delta t_{av} = 0$. This follows form the conceptual model illustrated in Figure 2 and Figure 3. The SPS has a zero-distortive marginal effect on farm rental decisions when there are insufficient entitlements relative to eligible area. This result is not affected by the SPS model applied in the pre-reform period (e.g. by historical, hybrid or regional model) or by the four studied reform elements as long as the stock of entitlements remain in deficit relative to the eligible area.

Appendix 2: Derivation of land demand elasticity

Empirical studies estimating land demand elasticises are scarce. For this reason we derive the land demand elasticity using cost minimization problem assuming Cob Douglass production function. Then we extract production function parameters from literature to calculate the land demand elasticity based on derived formula. The estimates on production function parameters are more widely available in the literature and thus it is easier to obtain the land demand elasticity using this indirect approach.

We consider cost minimization problem where representative farm minimizes the sum of land and non-land costs for a given production quantity, *Q*:

(12) $Min \ \ rA + wL$

(13) $Q = BA^{\alpha}L^{1-\alpha}$

where *w* is price of non-land input, *L* is quantity of non-land input, *B* is production function parameter and α and 1- α are production function elasticises with respect to land and non-land input, respectively. Consistent with usual assumption and commonly found empirical evidence in the literature, we assume constant return to scale production function (Petrick and Kloss 2013).
Defining Lagrange function, deriving FOC conditions and then solving for land demand elasticity, $\eta^D = (dA/dr)(r/A) = (dD/dr)(r/D)$, yields

(14) $\eta^D = -(1-\alpha)$

The estimates of Mundlak et al. (2012) for 30 developing and developed countries, Ciaian and Kancs (2011) for eight NMS and Petrick and Kloss (2013) for eight EU countries show that the production function elasticity of land varies between -0.15 and 0.54. The estimates of Petrick and Kloss (2013) suggest that the elasticity is lower for the EU than for non-EU countries. Based on the results of Ciaian and Kancs (2011) and Petrick and Kloss (2013) we consider the variation of the land production elasticity between 0.05 and 0.2. This implies the land demand elasticity derived from equation (14) is in the interval between -0.95 and -0.8.

LF-NA-27940-EN-N

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub - Joint Research Centre

Joint Research Centre

EU Science Hub

Publications Office

doi:10.2791/698744
ISBN 978-92-79-58541-8